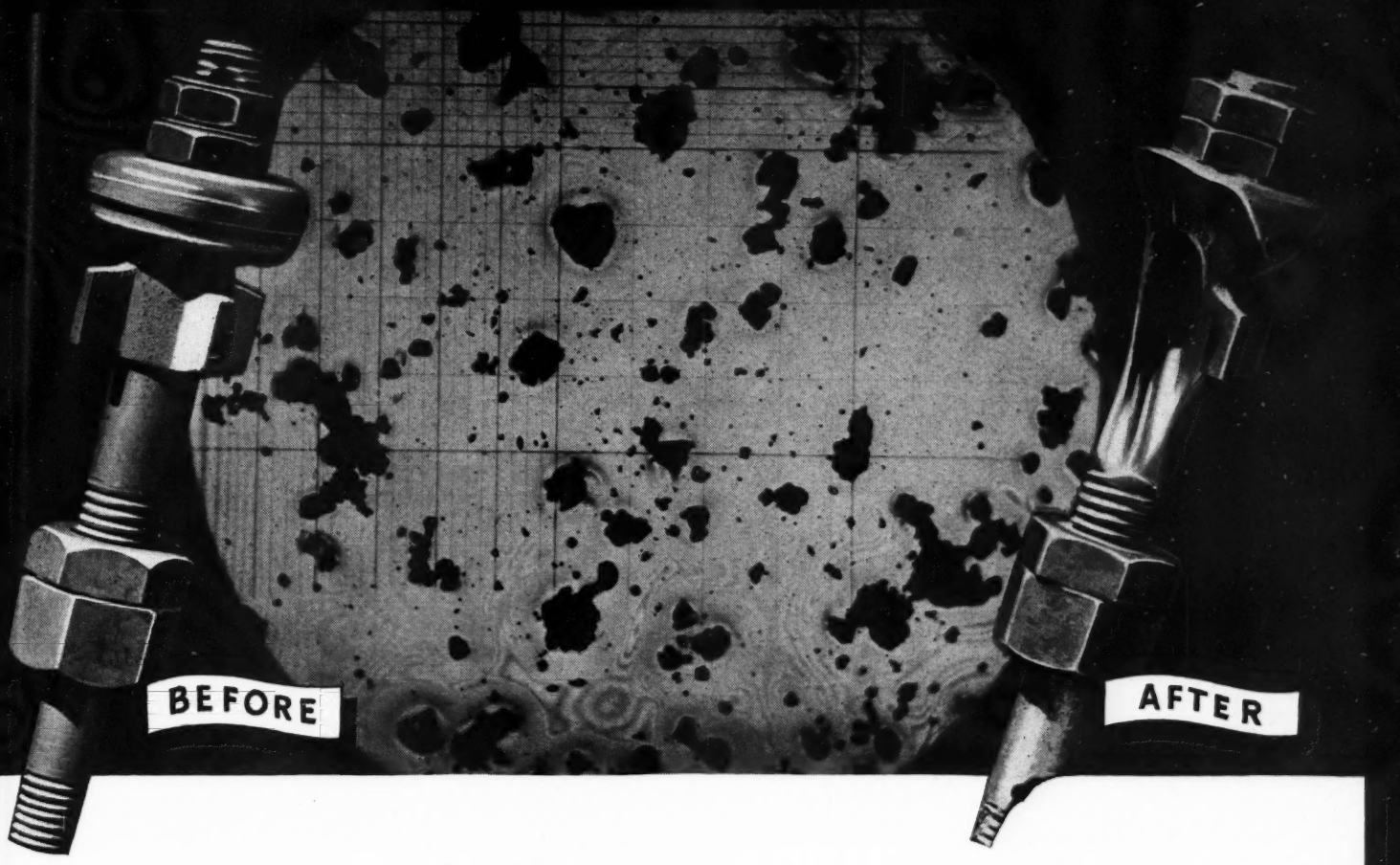
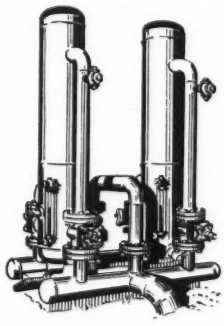


The Toll of "MICRONIC BOMBING"



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In this photomicrograph, gas line dust particles of micronic proportions are visible only because they have been magnified 40 times! They were photographed from an actual sample representative of dust that caused the damage to the valve regulator stem at right. In this instance dust not only eroded the valve stem, but blasted a hole through the body . . . escaping gas was ignited by a spark, setting the regulator building afire and cutting off the town's gas supply! Such dramatic exhibitions of dust's damage may be few and far between but—dirty gas *always* increases transportation expense, seriously affects accuracy of metering and pressure regulation and is responsible for increased service calls and costs.

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GAS

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Twenty-Sixth Year of Publication

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GAS is published monthly by Jenkins Publications, Inc., 198 South Alvarado Street, Los Angeles 4, California. Subscription price, United States and possessions, Canada, Mexico, Cuba, South and Central American countries (in advance), 50 cents the copy; one year, $2.00; two years, $3.50; three years, $5.00. All other countries, $3.00 per year. Acceptance under Section 34.64, P. L. & R. authorized. Member: The Controlled Circulation Audit, Inc.; National Business Publications, Inc.; Society of Business Magazine Editors. GAS is indexed regularly by Engineering Index Inc. Publishers: BUTANE-PROPANE NEWS; Handbook BUTANE-PROPANE GASES; BOTTLED GAS MANUAL, WESTERN METALS.

Highlights

BIG CASES BEFORE THE BAR. Oral argument began June 19 in Wash- on the San Juan line which El Paso Natural wants to build to the California border. Intermediate decision procedure was omitted . . . Similar action brought the Michigan-Wisconsin application (to double the capacity of its Texas-Michigan line) before the commission June 15 . . . Algonquin, in hearings on its plea to carry gas to New England, said with extra boosters it could raise capacity to 260 to 360 MMcf per day . . . Prince George's Gas Corp. wants to build a 20-mile line from Rockville, Md., to Washington to bring an added 122 MMcf to the nation's capital . . . Further hearings at a postponed date will be scheduled in the matter of how Panhandle Eastern will distribute it's authorized to receive from Trunkline's Louisiana-to-Illinois system.

STATE-OWNED LINES FOR MASSACHUSETTS? A state legislative committee has favorably reported a bill authorizing the issuance of $25 million in bonds to build natural gas lines throughout the state.

MR. SMITH STAYS IN WASHINGTON. Retiring FPChairman Nelson Lee Smith, whose term has expired, has been nominated by the President for another term and unanimously approved by the Senate Commerce Committee. New Commissioner Mon C. Wallgren has been named chairman, Thomas C. Buchanan is vice chairman.

SERVEL ON THE PAN. Both the Justice Department and a Pittsburgh grand jury are gunning for the gas-refrigerator maker. DJ says Servel is a monopoly, holding agreements with foreign manufacturers to protect its domestic market and buying up patent rights in the U.S. to forestall competition. In Pittsburgh, the jury says Servel conspired with distributors to fix prices. Servel is getting ready to fight back.

TEXAS-ILLINOIS LINE CERTIFICATED. The $117 million Peoples Gas Light & Coke Co. subsidiary will begin construction immediately on the 1331-mile, 305 MMcf capacity line which will haul gas from Texas fields for use in Chicago, Northern Indiana and adjacent areas.

BARKLEYS DEDICATE NEW EAST TENNESSEE LINE. The Vice President and Mrs. Barkley did the honors June 17 when natural gas was turned into the Knoxville, Tenn., system from the newly completed East Tennessee Natural Gas line (GAS, May, p. 99).

HOUSEHEATING DRIVE UNDER WAY. This month GAS salutes the opening of the AGA summer campaign with this special Househeating Issue. Biggest kickoff splurge to date has been Servel's June 21 press luncheon announcing production of a single-unit heater and air conditioner. For a market report, see pp. 23-25.

All Aboard

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EDWARD TITUS

THERMALLY THINKING

The Battle's Becoming Bitter

THE FACT THAT THE PROPONENTS of competing fuels are resorting to tactics that are a bit on the desperate side is an indirect feather in the cap for gas in the house heating field.

At the same time it behooves the industry to be on its toes and not lose by default or over-confidence any skirmishes in the Battle of the Fuels.

It is therefore most timely that the promotion campaign of the American Gas Assn., in behalf of gas house-heating, is now under way. It is not as extensive and all-out an effort as was at first planned. This is due to limitations on house heating that still restrict many companies. Next year, however, a more comprehensive campaign is expected.

The bitterness with which the fight can be waged is seen right on Staten Island, part of the greater city of New York, where natural gas was introduced last fall, and partisans of a competing fuel have used the mails to circulate near-scurrilous material about gas.

Meanwhile a movement is developing to form local groups of various names such as "oil heat institutes" to foster ideas in the mind of the public to retard the powerful onward surge of gas.

This idea, which originated in Baltimore, is spreading to various areas soon to get natural gas.

The first attack of the Oil Heat Assn. of Maryland in Baltimore has been on fuel cost. They have attempted to convince Baltimore residents that current conversion from manufactured to natural gas in that area will not bring gas heating costs down to the level of oil heat. That association is spending $25,000 on the campaign this year, and plans a $100,000 campaign in Baltimore next year.

Meanwhile in southeastern Pennsylvania, an oil institute is reported ready to spend $100,000 in the same cause.

This kind of thing cannot be viewed with complacency. There has been a tendency in some quarters to sit back and regard the gas heating load as something that will fall into the lap of the gas industry anywhere and everywhere the industry is able to handle it.

The fact is that a lot of gas is going to arrive in the Northeast soon. It is the finest fuel the world has ever known, and some of it perhaps will sell itself, but probably not all. There will have to be some real selling done for the industry to take full advantage of its greatest opportunity.

The finest large crop of peaches there had ever been would not fully sell itself, without some pushing, particularly if (just to think of something fanciful) the apple growers had gotten together and were circulating propaganda against peaches.

Now for the constructive side of the picture:

The know-how of promoting gas heating has been wrapped up into a package by the AGA in the "Sell 'Em Comfort" promotion, a PAR activity. In support of this effort by the AGA, the present issue of *G A S* has the subject of house heating as its principal theme.

Recognizing that many utilities, because of the current situation, cannot go all-out in promoting house heating, or perhaps cannot promote it at all, the AGA has developed a program that can be followed by such utilities, and will help keep their dealers happy in the interim before heating can be unreservedly sold.

It is a common-sense program, which will produce some appliance sales returns, and keep up the good name of house heating among a utility's customers.

Elements of the Program

Known as the "recommended house heating program where all-out promotion is not indicated," the program involves the following:

1. Replacing old conversion jobs with modern gas designed equipment.
2. Replacing unreliable and unsafe conversion burners with burners of acceptable quality or with gas-designed equipment.
3. Replacing old gas-fired jobs with new equipment.
4. Installing central heating systems to replace non-central gas-heating equipment.
5. Replacing various equipment with floor furnaces.
6. Replacing other gas heating systems with year-round air conditioners.

The program this year combines house heating, all-year air conditioning and incineration. Next year these programs are likely to be divided and the effort enlarged.

Among the effective sales tools provided by the AGA are a 28-page gas househeating sales maker, which is a full manual of how to sell gas househeating; and a *Guide for Installers*, sponsored by the gas house heating committee of the AGA.

Compact and important is a consumer folder which lays it on the line in unmistakable language about the advantages of gas. Lest we forget, a few of these fundamental advantages:

Convenient. No furnace tending.
Clean. Gas is a pure concentrated fuel.
Dependable. No storm can interrupt gas service.
Guaranteed. Look for two famous symbols on gas heating equipment—the maker's trademark and the AGA Laboratory approval seal.
Modern. The gas heating streamlined unit makes a basement roomier, more livable.
Silent. Gas heating is your servant 24 hours a day.
Direct. Gas comes to you ready to use.
Healthful. Gas provides even heat and clean air.
No hidden costs. You pay for fuel only.
Low upkeep. Repair and maintenance bills are negligible.
A longer life. Fewer moving parts mean less wear and tear.
More stable prices. Gas rates fluctuate less than do prices of other fuels.

Emphasizing the importance of keeping in touch with builders and architects, and with remodelling projects, bear in mind the thought that once gas heat is installed the other uses almost automatically go to gas.

And remember Levittown—

This was the big development on Long Island in New York State that went to competing fuels, due doubtless to the extraordinary circumstances of the mains not being extendable at the time. But let's not let Levittown happen again.

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* Patent Pending

GUY CORFIELD

TECHNICAL TRENDS

Developments In Heating

NEXT TO FOOD, heat is probably the greatest human necessity and its procurement and development involve one of the greatest expenditures of naturally available energy. A recent issue of the *Scientific Monthly* states that space heating costs Americans about $3.5 billion per year and uses up about 30% of our fuel output. Many advances have been made from the primitive open fire, but it is interesting to remember that it was man's first means of heating and to note that he still clings to it with fireplace and chimney, although for sentimental and decorative reasons rather than for basic comfort.

Great ingenuity has been exercised in heat production and application. Large public buildings are warmed principally by "central heating" steam which can be distributed through large areas and even districts, although "district heating" is said to be on the decrease—possibly because of the high cost of installing and maintaining insulated piping; hot water and warm air are used to a lesser extent in large volume heating, but are employed for the majority of commercial and residential applications. It is in commercial and residential heating that variety and new developments are most manifest; and, particularly since the last war, gas residential heating has developed in such volume and variety of design that it is difficult for even a heating engineer to keep up to date on a national basis. This has, of course, been brought about by the flexibility and adaptability of gas fuel and the mushrooming and high competitive situation in low and medium cost housing.

In this modern housing field particularly, several trends can be noticed, some good, and others presenting some difficulties. First, and perhaps the most important, is the trend towards vented heat, or away from unvented appliances except for small and more or less incidental or temporary heating purposes; this would seem to be a generally advantageous trend, and particularly desirable with the concurrent construction of prefabricated and other tightly built houses which keep infiltration or normal ventilation to a minimum, and would therefore promote buildup and condensation of combustion products if these were released in the house.

Another trend, which becomes a necessity in the case of the solid floor slab or "slab-on-ground" type of small house, is the elimination of basement and conventional floor furnaces, which results in locating the heating appliances (except individual room heaters) in a closet or alcove, in a wall, or in the attic. This, and the accompanying trend toward making appliances smaller in size (but not in Btu input), or to allot smaller space to the appliance (because space in a modern house is at a premium), has introduced a variety of problems.

The following are a few typical situations and problems that they pose: (1) When only a small alcove or closet or restricted attic or roof space is made available for installation, designing the appliance so that it can operate safely when very close to or even in contact with the walls or top of the space, and controlling the installation so that proper air supply and venting are provided; (2) When only space in a wall (which often is an internal wall) is afforded, designing the appliance and controlling its installation so that it can safely be in contact with wall studs and vent up through the wall space; (3) When it is desired to heat the entire house from one appliance to control the location of warm air registers and installation of warm air ducts so that the heat will be adequately and safely distributed.

Another trend is to attempt to heat portions of the house by "overflow" heating; i.e., the appliance is installed in a central enclosure or partition so that it delivers heat directly into one or two rooms and also discharges heat into a hall from which other rooms, such as bedrooms and bathroom, are heated by "overflow." This may be an economical installation in first cost, but the inconvenience of always having room doors open to receive heat is obvious, and there is the possibility of closing all doors and seriously overheating the hall—and the vent, also, if combustion air is taken from the hall.

"Radiant" Trends

Other trends which are developing are the so-called "radiant" methods by means of heated floors, walls, ceilings or baseboards. Such heating is done by hot water in concealed pipes, or warm air in concealed ducts or hollow panels in walls or ceiling. One of the latest developments is "perimeter heating," whereby heated air is forced through uninsulated sheet metal ducts, of a diameter such as 8 in., embedded in the concrete floor slab and traversing essentially the perimeter of the house; these ducts supply floor or baseboard registers in suitable locations, as well as general warmth to the floor slab. The furnace can be installed anywhere in the house, customarily in a more or less central utility space; it conventionally discharges its warm air from the top and then immediately downward into a plenum, also cast into the floor slab, from which two or more ducts radiate to the perimeter.

Rather obviously, this rapid evolution of heating appliances and systems presents many and continuing problems for those entrusted with development and application of AGA approval requirements. The attempt is to retain control of safety, efficiency, durability and serviceability, and to forestall improper installation as much as possible, without restricting design and inventiveness. The variety and complexity of modern heating appliances is evidenced by the following list of types that have been set up within the requirements organization:

> Central heating, including boilers, central furnaces, floor furnaces, recessed heaters; conversion burners, duct furnaces, unit heaters, room heaters.

A separate approval requirements sub-committee handles each type. Many individual designs have features which overlap two or more types, making the decision as to jurisdiction difficult; and the existence of four sub-types of central heating makes this group so complex, and the requirements so bulky, that further subdivision is being discussed.

The importance of gas heating is of course recognized by the AGA domestic gas research committee, which includes in its organization the technical advisory group for heating and air conditioning research. This group supervises research on heating appliances and related venting practices.

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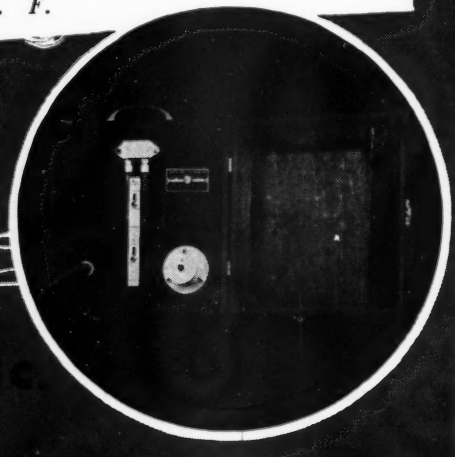

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STANLEY JENKS

PROMOTIONAL NOTES AND NOTIONS

Beating the Heating

As my AGA Sales Promotion Calendar reminds me daily, July is the month when we inaugurate our first post-war gas heating campaign.

Never, as I remember it, have we entered any gas promotional activity with more prospects of a great success. The timing is perfect. The public wants the benefits of care-free, completely controlled gas heating. We have the equipment available at last, and we have the capacity to handle the business.

While, through the years, gas for heating has been superior to any other fuel, it must be remembered it has taken years of constant plugging, pavement pounding, and sales savvy to create the mass market existing today, especially in the manufactured and mixed gas areas. And another thing to be appreciated is that the competitive fuel economics are now in our favor. The important thing is that the time is ripe, and, if the proper seed is planted during the three summer months, what a crop of gas house heating can be gathered this fall and winter!

All Year Conditioning

Final public acceptance of gas as the superior fuel for home heating is a general recognition of the fact that, more than the physical need to keep warm when the chilly winds are blowing, the public seeks effortless comfort with a maximum provision for healthiness as furthered by an even indoor temperature.

Which brings up the point that heat alone, no matter how good it is, is only one of several factors that make for real home air conditioning. We must have proper humidification, because too little hurts the nose and throat and damages antique furniture, carpets, and rugs. Then, if 70°F, with the proper humidity, is a healthy winter indoor condition, it stands to reason that 85°-90°F, with relative humidities above normal, is anything but healthy in the summertime. In other words, an even condition throughout the year is the goal. Eventually, why not now? Especially when we in the gas industry have the equipment available to provide exactly this. All in one unit too, so that the basement doesn't have to be cluttered up like a Goldberg contraption.

All-year air-conditioning is the greatest undeveloped single service the gas industry can offer its customers.

It is certainly our foremost opportunity today.

Encouraging Signs

In its May 25 quarterly report to stockholders, Servel Inc. tells us it doubled the shipments of gas refrigerators and automatic gas water heaters over those for the same quarter last year. For the first six months of this year, its "all-year" air conditioner shipments were almost double.

However, as the report says, the most significant factor in the second quarter's operations was that all divisions of the company were in the black for the first time in the second quarter for several years, such being the previous seasonal pattern of the businss.

The gas industry is served by as fine a group of appliance and equipment manufacturers as you can find anywhere. Their prosperity is essential for our continued development and growth, for we need the research and product betterment that can be obtained only when earnings can be ploughed back into these enterprises. Open and aboveboard competition takes care of pricing, which can be trusted to maintain an equitable level if not too harassed by utility finicky restrictive practices, hampering standardization, and mass production.

Another encouraging sign comes from a temperature and pressure relief valve manufacturer, who told me the current GAMA Court of Flame automatic water heater campaign has him hanging on the ropes keeping up with an unprecedented rush of orders.

And are you following what is happening to natural gas securities? The investing public is really gas-minded in a big way.

While all is anything but well with the world, there are encouraging signs in the gas world that our constant promotional effort is paying off.

Heart Interest

Ticker trouble is too prevalent for comfort these days. It is an inevitable consequence of the anxieties of the recent war and the trials and tribulations of our post-war shakedown period. There is only one answer—talking from personal experience too—relaxation and a replotting of life to cut down physical strain.

The kodochrome sound slide film, issued by the AGA in cooperation with the New York Heart Assn., is excellent promotional material for two very good reasons. It is timely and very much to the point. Built around our New Freedom Gas Kitchen, it clearly presents, in terms of human interest, another gas service tie-in with the general betterment of our customers.

Do your local heart chapters and your home service department have copies?

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And regardless of how long they've been in service, these valves are easy to operate. Crane parallel seat and double disc construction assures pressure-tight closing... easy opening. Available in Non-Rising Stem and O. S. & Y. patterns. See your No. 49 Crane Catalog.

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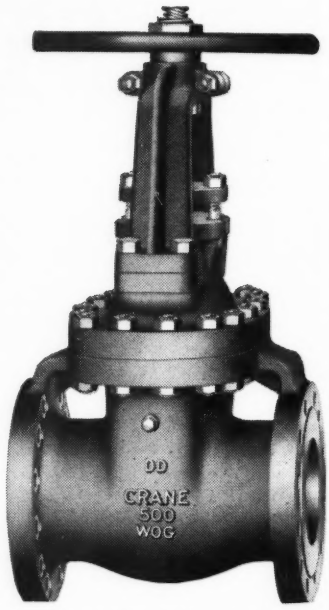

No 343E, Flanged Gate. Working Pressure: 500 pounds cold water, oil, or gas. Sizes: 2 to 12-inch. Screwed end valves in sizes up to 4-inch.

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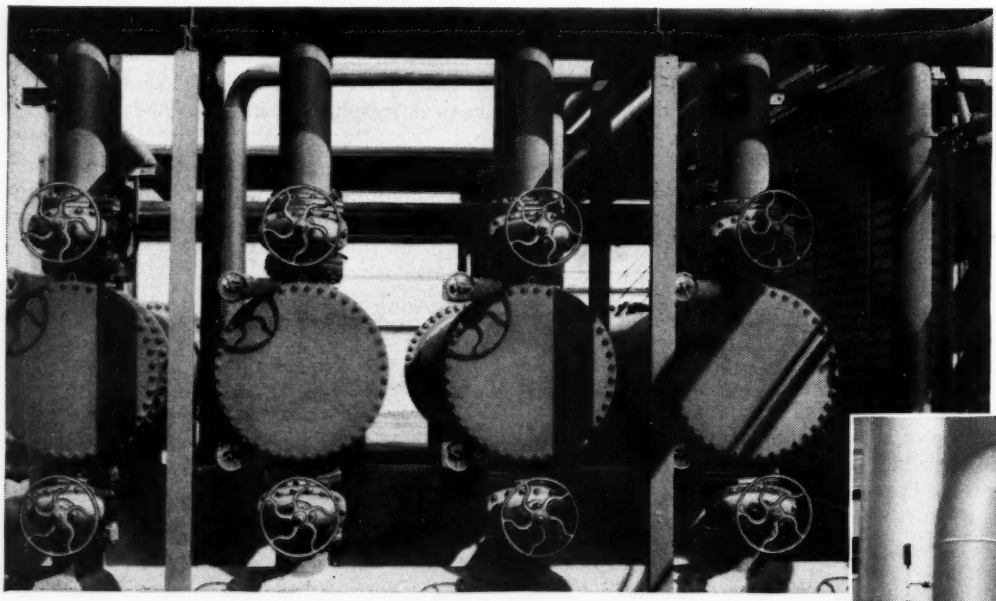

GAS COOLERS *in a natural gasoline plant equipped with Crane 125-Pound iron body wedge gate valves, pipe, and fabricated piping.*

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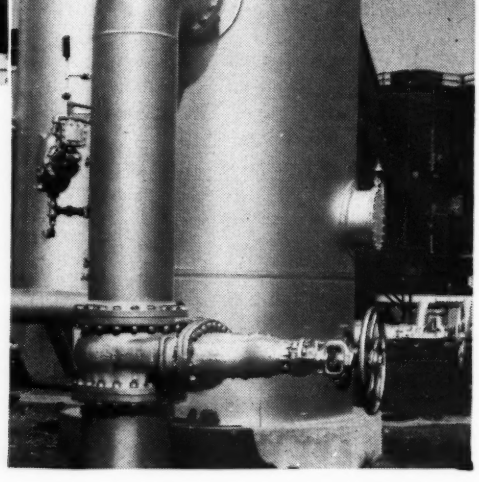

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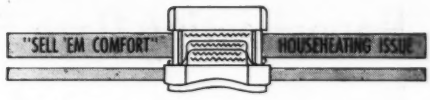


A Million Potential New Customers Await 'Sell 'em Comfort' Campaigners

Nation's gas companies see biggest househeating year ahead, despite lingering restrictions...record appliance shipments, booming pipeline programs point the way.

THIS is the kickoff month for the AGA "Sell 'Em Comfort" househeating campaign.

This is the season when manufacturers and retailers—*and* utilities—can look forward to the biggest potential heating market in history—a potential of more than 1 million *new* installations.

Even so, this is a figure that reflects some disappointments. The AGA (as Edward Titus points out in his comments this month on p. 17) has had to pull in its horns a bit on this campaign because certain gas companies *still* cannot accommodate all the new comfort customers who have fallen into their laps.

The *GAS* estimate is a reasonable projection of figures compiled in an exclusive nationwide survey in which 105 leading gas utilities who sell gas to more than 50% of the total residential customers in the United States participated. These 105 expect to add to their lines for the 1950-51 heating season 728,209 users.

Last year they permitted 711,065 customers to enjoy the comfortable glow of this precious fuel for the first time.

The anticipated increase over last year—17,000, or a minuscule 2%—is ultraconservative. Witness, first, that eight companies were unable to even guess at this year's increase in business. More important is this fact: In 1949, when the AGA made a survey of househeating restrictions, these same companies reported anticipated customer increase of less than 450,000. Performance, therefore, exceeded prophecies by more than 250,000. That's about 55%. If 1950-51 should match 1949-50 in ratio, these 105 companies alone would add more than 1,100,000 installations!

Such a wild projection is, of course—well, wild. Most companies presumably know their markets and their future supply pictures better this year than last, and are less likely to err quite so far on the side of conservatism. Still, one cannot dismiss the fact that actual sales of the 105—711,065—for 1949-50 exceeded by more than 18,000 the anticipated sales of 692,700 guesstimated by the entire 271 companies who participated in the AGA study!

Further evidence of the fact that this should be the greatest year ever is borne out in the fact that when GAMA made a similar survey two years ago, 263 companies saw a relatively modest figure of 472,059 in the crystal ball.

More evidence:

GAMA reported, on June 15, that preliminary figures on shipments of gas-fired furnaces, boilers, and conversion burners—*central heating equipment only*—for the first five months of 1950 reached a new high of 307,400 units, an increase of 164.5% over the corresponding period in 1949. Furnaces were up from 58,900 to 171,200, a 191% increase. Boiler shipments hit 18,300, 67.9% better than 1949's 10,900. Conversion burner makers sent out 117,900 of their product, a 154.1% jump over 46,400 for January-to-May 1949.

Furthermore, in furnace shipments, 1949 was the best previous year. Pre-

An Exclusive GAS Househeating Survey

Househeating Data for 105 Companies
New Customers and Local Preferences

COMPANY and LOCATION	Customers Added in 1949-50	Additional Customers Expected in 1950-51	Customers' Preference in Househeating Equipment 1st	2nd
Alabama				
Alabama Gas Corp., Birmingham	10,000	7,500	Floor furnace	Conversions
Arizona				
Arizona Edison Co. Inc., Douglas	650	500	Circulating	Forced air
Central Arizona Light & Power Co., Phoenix	4,000	?	Circulating	Wall furnaces
Tucson Gas, Electric Light & Power Co.	4.500	3,500	Circulating	Central furn.
Arkansas				
Arkansas Western Gas Co., Fayetteville	300	300	Floor	Central
California				
Coast Counties Gas&Electric Co., Santa Cruz	5,600	5,000	Floor	Wall
Pacific Gas & Electric, San Francisco	41,000	42,000	Floor	Circulating
San Diego Gas & Electric Co.	5,500	6,500	Wall heaters	Circulating
Southern California Gas Co., Los Angeles	65,000	54,000	Floor - wall	Circulator
Colorado				
Public Service Co. of Colorado, Denver	11,617	8,000	Circulating	Conversion
Pueblo Gas & Fuel Co.	1,413	1,500	Warm air	Conversion
Connecticut				
Connecticut Power Co., New London	7	?	Console	Unit
Greenwich Gas Co.	24	20	na	na
Hartford Gas Co.	388	350	Central	Hot water
New Britain Gas Light Co.	2	6	Kitchen heating	Central conv.
Norwich Gas & Electric Department	29	75	Hot water	Hot air
Delaware				
Delaware Power & Light Co., Wilmington	388	800	Warm air	Hot water
District of Columbia				
Washington Gas Light Co.	14,340	17,052	Forced air	Hot water
Florida				
Peoples Water & Gas Co., Miami	na	na	na	na
Illinois				
Central Illinois Electric & Gas Co., Rockford	750	600	Central heating furnace	.....
Illinois Power Co., Decatur	5,765	?	Conversion	Warm air
Mount Carmel Public Utilities Co.	2	0	na	na
North Shore Gas Co., Waukegan	400	300	Forced air	Conversion
Peoples Gas Light & Coke Co., Chicago	12,000	14,000	Conversion	Circ. room heaters
Union Electric Power Co., Alton	900	1,000	Conversion	Furnaces
Indiana				
Central Indiana Gas Co., Muncie	none	2,000	Conversion	Central
Citizens Gas & Coke Utility, Indianapolis	none	na	na	na
Indiana Gas & Water Co., Inc., Indianapolis	877	6,000	Forced warm air	Floor
Iowa				
Iowa Power & Light Co., Des Moines	3,000	3,000	Warm air central	Unit heaters
Iowa Public Service Co., Sioux City	1,000	5,000	Furnaces	Conv. burners
Key City Gas Co., Dubuque	10	10	Forced air	Boilers
Kansas				
Kansas Public Service Co., Lawrence	310	350	Conversion	Warm air
Kentucky				
Louisville Gas & Electric Co.	8,000	8,000	Conversion	Furnaces
Union Light, Heat & Power Co., Covington	4,000	4,500	Conversion	Forced air
Louisiana				
Arkansas-Louisiana Gas Co., Shreveport	4,179	?	Radiant fires	Floor
Louisiana Power & Light, New Orleans	4,880	3,280	Radiant fires	Floor
New Orleans Public Service Inc.	4,000	4,400	Space	Floor - wall
Maryland				
Consolidated Gas, Electric Light & Power Co. of Baltimore	1,296	14,750	Conversion	Boilers
Cumberland & Allegheny Gas Co.	1,849	2,000	Conversion	Furnaces
Hagerstown Gas Co.	14	300	Space	Warm air
Massachusetts				
Boston Consolidated Gas Co.	400	500	Forced air	Hot water boilers
Cambridge Gas Light Co.	227	300	Conversion	Cabinet
Fitchburg Gas & Electric Light Co.	4	?	Conversion	Warm air
Greenfield Gas Light Co.	0	0	na	na
Malden & Melrose Gas Light Co.	0	100	na	na
Springfield Gas Light Co.	300	250	Forced air	Gravity air
Michigan				
Menominee & Marinette Lt. & Traction Co.	1	3	Furnaces	Conversion
Michigan Consolidated Gas Co., Detroit	98,000	100,000	.....	.....
Minnesota				
Minneapolis Gas Co.	11,700	18,000	na	na
Mississippi				
Mississippi Power & Light Co., Jackson	6,662	5,245	Floor	Space
Missouri				
City Utilities of Springfield	2,000	1,500	Furnaces	Boilers
Citizens Gas Co., Oronogo	10	10	Floor furnaces	.....
Laclede Gas Light Co., St. Louis	28,000	50,000	Conversion	Furnaces
Missouri Gas & Electric Serv. Co., Lexington	280	200	Circulators	Conversion
Montana				
Billings Gas Co.	950	700	Forced air	Gravity warm air

(Continued on next page)

war, the average was 11,800. Boiler shipments were off from 1947's high of 20,000, but far, far ahead of prewar's 2630. Conversion burners, prewar, were only 6750; the peak year, 1946, saw 118,000 shipped in five months. And conversion burners were admittedly in a runaway market in 1946, before restrictions were in force in any but a few areas.

Still more evidence: GAMA recently released a "Natural Gas Supply and Construction Study" which showed that during 1949 the Federal Power Commission approved the construction of 7537 miles of pipeline, to carry 3 billion cu ft per day of natural gas, much of it to untapped markets. As of Feb. 1, additional pipeline certificate applications were pending which provide for an aggregate of 4.7 billion daily.

Goliath Strides

Saturation of the heating load is, of course, trending upward in mammoth strides. In GAMA's 1948 report, of 18,134,809 residential customers of the 263 reporting companies, 5,365,440 used gas for househeating—a ratio of just under 30%. In AGA's 1949 study, the percentage had crept up to 33%. For the 105 companies covered in the *GAS* survey, it was then about 40%.

While actual current saturation figures are not available, the sum of the househeating customers on the lines of the 105 companies as of May 1, 1949, plus actual additions in 1949, plus anticipated additions this year, is about 52% of the total residential customers of these companies—as of May 1, 1949. Not a saturation figure, this nevertheless shows just how large the househeating load is bulking these days.

We could quote, from dozens of other sources, substantiating facts and figures to show that gas househeating is truly headed for almost unbelievable acceptance. But let's look at what the AGA is doing to help utilities help their dealers cash in on this great market.

Mapping the Campaign

For July, August, and September, the association is providing a portfolio, recently released, which will guide utilities and dealers in laying out a campaign, whether it be a full-scale attack or a hold-the-line maneuver by those companies who are still unable to accept all the new customers the market offers.

The objectives of the drive are fourfold:

(1) To put the house in order, with emphasis on upgrading and replacement of poorly engineered installations.

(2) To replace worn-out equipment, or non-automatic, old-fashioned equipment that, while perhaps considered

adequate in its day, falls short of today's performance standards.

(3) To sell summer air conditioning to customers already using gas for winter heating, thus helping to level the annual load.

(4) To sell equipment to new users. Although last, this is the most important of the four objectives, and, with utilities in a position to accept new installations will receive the most attention.

Iron Fist, Silk Glove

While the opportunity is there, utilities are facing a bitter fight in many areas, and perhaps the most frustrated are those who feel unable—because of restrictions—to fight back at the anti-gas assaults that are now beginning to shape up in the east. Among the first battlegrounds were the markets around Baltimore and Washington, D. C., where the oilmen were going to pretty desperate lengths to discredit gas. For example, the Oil Heat Assn. of Maryland's advertising made this point:

"Why are 130,000 Baltimore homes heated with oil and only 17,000 with gas?"

The answer, in part: "Oil heat costs less . . . oil heat is safe."

The ad failed to state that most of the 130,000 customers were sold before natural gas was first received in Baltimore or that while oil heat is relatively safe, gas is the safest of all fuels.

The gas company countered with copy that read:

"Ninety-seven out of every 100 new homes connected to the gas lines in metropolitan Washington installed natural gas heat."

High-Altitude Prices

Another line of attack is that, while gas is available from one source only, "a public utility whose profit is assured with competition forbidden," many dealers sell fuel oil. The ad very neatly sidesteps the issue of supply and demand, and the fact that free competition has permitted the price of fuel oil to fly off into the stratosphere.

The holes in the argument are all too obvious to anyone with even a smattering of knowledge of the industry, or of recent history. But is it making an impression on the all-important consumer who is the final arbiter?

The campaign has already spread to far-off Milwaukee. As competition stiffens and as natural gas threatens to encroach upon new areas, its impetus will quicken.

The "battle lines are drawn" and some quick, strong counteroffensives are in order. The AGA "Sell 'Em Comfort" drive seems an excellent one to start with.

Househeating Data for 105 Companies
New Customers and Local Preferences

(Continued from page 24)

COMPANY and LOCATION	Customers Added in 1949-50	Additional Customers Expected in 1950-51	Customers' Preference in Househeating Equipment 1st	2nd
Nebraska				
Central Electric & Gas Co., Lincoln	4,400	5,200	Conversion	Hot air
New Hampshire				
Manchester Gas Co.	18	20	Conversion	Warm air
New Jersey				
County Gas Co., Atlantic Highlands	425	620	Floor	Conversion
Elizabethtown Cons. Gas Co., Elizabeth	0	0	.....	.....
South Jersey Gas Co., Atlantic City	160	800	Forced warm air	Boilers
New York				
Binghamton Gas Works	2,910	3,000	Conversion	Furnaces
Brooklyn Union Gas Co.	2,000	1,500	Boilers	Conversion
Central Hudson G & E Corp., Poughkeepsie	122	200	Conversion	Furnaces
Keystone Gas Co., Olean	149	500	Conversion	Furnaces
Kings County Lighting Co., Brooklyn	261	250	Steam	Water
Long Island Lighting System	none	?	Boilers	Furnaces
Republic Light, Heat & Power Co., Buffalo	1,200+	?	Hot air furn.	Conversion
Rockland Light & Power Co., Nyack	1,002	1,000	Conversion	Furnaces
Westchester Lighting Co., Mt. Vernon	800	1,800	Winter air conditioning	Boiler
Ohio				
Cincinnati Gas & Electric Co.	14,500	18,400	Conversion	Forced air
East Ohio Gas Co., Cleveland	60,000	55,000	Conversion	Forced air
Ohio Fuel Gas Co., Columbus	81,200	42,200	Conversion	Furnaces
Ohio Gas Co., Bryan	310	?	Forced air	Circ. heaters
Oklahoma				
Northern Oklahoma Gas Co., Ponca City	450	400	Floor	Unit types
Oklahoma Natural Gas Co., Tulsa	14,500	14,000	Floor	Warm air
Oregon				
Portland Gas & Coke Co.	266	1,100	Circ. heaters	Furnaces
Pennsylvania				
Equitable Gas Co., Pittsburgh	12,246	12,000	Conversion	Forced air
Lebanon Valley Gas Co.	none	10	.....	.....
Manufacturers Lt. & Heat Co., Pittsburgh	16,776	17,000	Conversion	Furnaces
Philadelphia Gas Works Co.	12,600	13,000	na	na
Rhode Island				
Blackstone Valley G & E Co., Pawtucket	401	300	Console	Kitchen
Newport Gas Light Co.	18	0	Boilers	Conversion
South Carolina				
S. C. Electric & Gas Co., Columbia	500	300	Forced air	Floor
Tennessee				
Nashville Gas & Heating Co.	2,000	2,500	Warm air	Floor
Texas				
Amarillo Gas Co.	1,800	1,600	Floor furn.	Vented wall
Empire Southern Gas Co., Fort Worth	680	650	Floor	Forced warm air
Houston Natural Gas Corp.	11,500	12,000	Radiant and Circulating	Central
Lone Star Gas Co., Dallas	35,000	35,000	Unvent. space	Floor
San Antonio Public Service Board	5,600	6,160	Port. space	Floor
Southwestern Public Service Co., Amarillo	1,276	1,000	Floor	.....
United Gas Corp., Houston	18,668	15,121	Nonvented	Central-attic
West Texas Gas Co., Lubbock	7,371	7,000	Space	Floor
Utah				
Mountain Fuel Supply Co., Salt Lake City	none	7,500	.....	.....
Virginia				
Richmond Department of Public Utilities	400	500	Hot water	Warm air
Suffolk Gas Co.	1	?	Unit heaters	.....
Virginia Electric & Power Co., Norfolk	0	?	Unit heaters	.....
Washington				
Seattle Gas Co.	746	750	Unit	Circulators
Washington Gas & Electric Co., Tacoma	25	?	Wall	Forced air
West Virginia				
Hope Natural Gas Co., Clarksburg	2,500	3,000	Floor	Circ. heaters
Natural Gas Co. of W. Va., Wheeling	2,184	3,000	Conversion	Furnaces
Wisconsin				
Madison Gas & Electric Co.	0	2,000	Conversion	Warm air
Milwaukee Gas Light Co.	5,000	20,000	Conversion	Warm air furnaces
Wisconsin Fuel & Light Co., Manitowoc	62	400	Conversion	Warm air
Wisconsin Gas & Electric Co., Racine	40	4,252	na	na
Wyoming				
Rocky Mountain Gas Co., Casper	650	500	Air furnaces	Air-floor
Dominion of Canada				
B. C. Electric Co. Ltd., Vancouver	10	0	na	na
Consumers Gas Co., Toronto	700	500	Conversion	Warm air
Northwestern Utilities Ltd., Edmonton	7,094	5,000	Furnaces	Space heaters
Confidential reports—two companies	14,020	16,450	Forced air	Circ. heaters
	711,065	728,209		

HOW IS RESEARCH IMPROVING THE PRODUCT?

ABOVE: Research residence No. 2, University of Illinois

1. Gas Househeating Projects Conducted Under PAR

In this review of research on gas house heating as conducted under the PAR plant of the American Gas Assn. it is proposed to list and comment briefly on the projects already completed, the work in progress, the new projects being started, and the new subjects being considered for study. An attempt will be made to reveal the scope of this undertaking with work under way at the AGA Laboratories, Cleveland; Battelle Memorial Institute, Columbus; University of Illinois, Urbana; and Purdue University, Lafayette, Ind. Possibly some conception will be obtained of the thorough screening of subjects before acceptance, selection of the best institution to do the work, the close supervision of each project, the careful editing of printed reports, and the active participation of committee members.

Dr. Vandaveer, chief chemist, The East Ohio Gas Co., Cleveland, is chairman of the AGA technical advisory group for heating and air conditioning research.

By F. E. Vandaveer

MANY factors have contributed to the phenomenal increase in house heating with gas fuel in recent years. The low cost of natural gas compared to other fuels, the ease of handling gas, its cleanliness, its dependability, the service supplied by gas companies and dealers, and last, but not least, the quality of gas-burning heating equipment and heating systems may be mentioned. Gas heating equipment has had a good record. Our appliances were ready for this expansion in house heating with gas fuel. Research and development by appliance manufacturers and the testing and certification program of the American Gas Assn. Laboratories extending over a period of nearly 25 years can be given the major credit for the progress which has brought this situation about. Research under the PAR plan has also contributed in a major way in the results produced and in the stimulation it gives the manufacturers to extend their own research and development, and in the encouragement it gives to gas companies.

Exclusive

If our present position in the house heating field is to be maintained and possibly improved, research under the PAR plan, as well as by others, must be accelerated. Scientific advancements and improvements in production methods are so numerous that research has become an essential part of successful business. This will necessitate greater effort by AGA committees in the future to select wisely the research projects of direct benefit to the gas industry, to anticipate where competition will make its greatest effort, and to recognize our own weaknesses and take steps to overcome them.

Completed Research

Completed research has been recorded in eight publications which are available through the AGA:

1. Report No. 1, *Literature Review on Corrosion of Metals and Materials by Flue Gas Condensate* (Battelle), February, 1947.
2. Research Series No. 103, *Venting Direct Gas Heaters When No Chimney Connections Are Available* (Purdue), June 1948.
3. Research Series No. 105, *Venting Direct*

Gas Heaters When No Chimney Connections Are Available (Purdue), September 1948.

4. Research Bulletin No. 51, *The Effect of Modulated Operation on Performance of Gas Warm Air Furnaces* (AGA Lab.), November 1948.

5. Research Bulletin No. 53, *Effects of Confined Space Installation on Central Gas Space Heating Equipment Performance* (AGA Lab.), February 1949.

6. Research Report No. 1108, *Research in Fundamentals of Heat Transfer in Central Gas Space Heating Furnaces* (AGA Lab.) March 1949.

7. *Pressure Loss and Air Flow Characteristics of a Box Plenum* (University of Illinois), June 1949.

8. Report No. 2, *The Corrosion of Mild Steel by the Products of Combustion of Gaseous Fuels* (Battelle), August 1949.

Copies Available

It would be impractical in this brief review to summarize the results of these valuable publications covering such topics as corrosion, venting, modulation, combustion air, and ventilation for equipment in small rooms, heat transfer, and box plenums. Copies of the complete reports may be obtained from the American Gas Assn. Inc., New York. The important thing is that the data and information in all of these publications are being used and the results are beneficial to the gas industry.

There are five active projects at present under the direct supervision of a committee member as technical advisor. Progress reports are received quarterly and studied by the entire committee. The oldest project, which will be completed this year, is on "Fundamentals of Heat Transfer" (DGR-1-CH). Samuel J. Levine is technical advisor and the work is being conducted at AGA Laboratories. A research bulletin on this subject will be issued this summer. Review of a preliminary copy has given me the impression that this bulletin will add a great deal to our knowledge of heat transfer. It will be highly technical but the application section, including graphs, will be directly useful in furnace design.

Second Study

A second project of direct interest where oil burners are strong competition ,entitled "Study of Performance Characteristics of Gas Boilers Equipped for Hot Water and Space Heating Service" (DGR-3-CH), with G. C. Beck as technical advisor, is also assigned to AGA Laboratories. Some very interesting data on using a house heating boiler for the hot water supply will be divulged by this study.

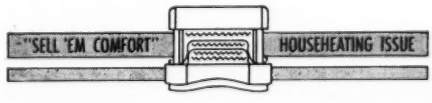
The third project on "Corrosion, Oxidation, and Deterioration of Metals Under the Influence of Products of Combustion of Gaseous Fuels" (DGR-4-CH) will be valuable to all appliance manufacturers and gas companies. The technical advisor is W. M. Myler Jr., and it is being conducted at Battelle. This is a long range project designed to develop information on corrosion of various metals and coatings caused by flue gases, sulfur, temperature, and oxidation.

F. E. VANDAVEER

Maximum Comfort

In the fourth project, factors that contribute to maximum comfort conditions in houses heated with gas are being investigated. Keith T. Davis is technical advisor for this work, which is being conducted at the University of Illinois. This is a joint project with the National Warm Air Heating and Air Conditioning Assn. The objectives of this study are to determine, under normal living conditions, the comparative comfort which can be obtained through use of different control methods (fast cycling vs. modulating controls) and operating cycles upon "cold 70," cold floor conditions, unbalancing of the system, and heat loss from duct work and casing; to determine trends in fuel requirements under the above conditions, including the effect of introducing all outside air into tight furnace rooms to meet requirements of combustion and ventilation; and to determine the effect which register locations may have on floor line temperatures under above conditions.

A fifth project deals with improvement of air distribution systems for all-year gas air conditioning (DGR-2-AC). H. C. Pierce and G. F. Zellhoefer are technical advisors and the work is being done in the mechanical engineering department at the University of Illinois. The objective of this study is to develop acceptable and economical methods for handling year-around operations of heating in winter and cooling in summer through one distribution system. It is hoped that information will be obtained to help offset the rising cost of air distribution systems without sacrificing performance.



Two New Projects

Two new projects are being started at the AGA Laboratories. One involves a study of draft control methods and equipment for gas space heating equipment. The other pertains to methods of supplying air to furnace rooms for combustion, venting, and ventilation.

Among the subjects being considered for future study are the three listed below:

1. Venting problems (particularly when no chimney is available)— effectiveness of vent cowls, special fabricated chimneys, and type "B" vents. The entire subject of venting is scheduled to receive special emphasis this year and next, and until many questions pertaining to venting are answered.
2. Methods of lowering wall temperatures adjacent to recessed wall heaters.
3. Possible extension of the heat transfer project.

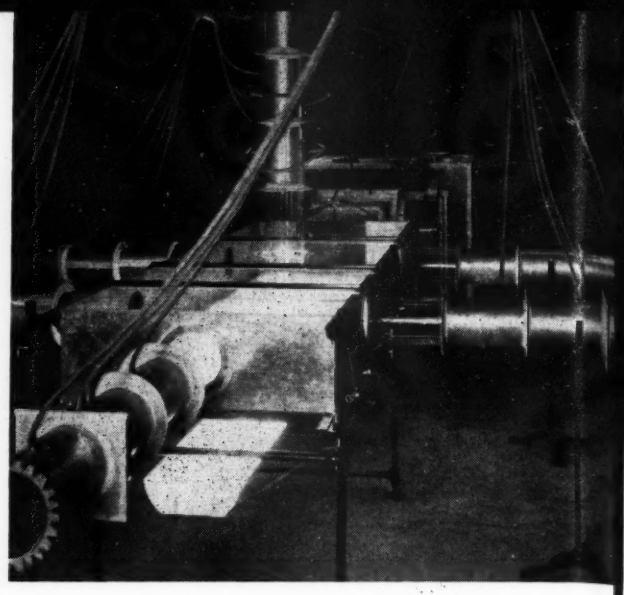
Recent consolidation of central heating, space heating, and air conditioning groups into one heating and air conditioning committee should strengthen our research effort. Experienced men in these three fields will pool their thinking on house heating and cooling problems, such as venting of flue gases, distribution of heat for maximum comfort and economy, distribution of cool air or hot air through the same system, corrosion, heat transfer, and others of a more detailed nature.

Comment Invited

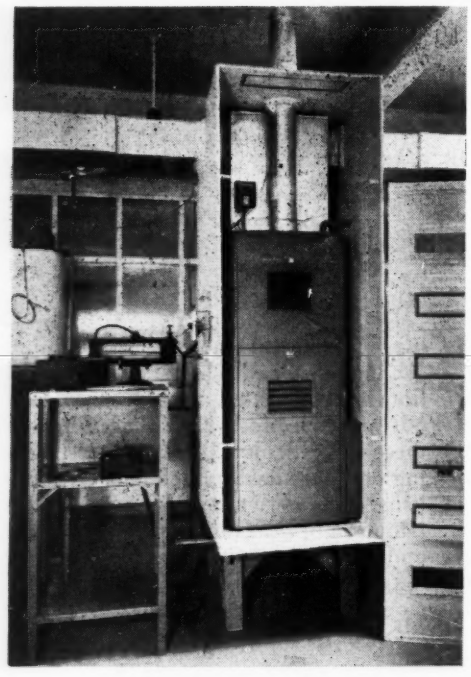
Our committee would welcome suggestions for research problems of direct interest to the gas industry. Such suggestions should be supported by facts and comments on the need for them. We would also welcome comments on publications already issued and the projects now in progress.

1. Eight publications by four nationally recognized research organizations have been issued to date on such subjects as corrosion, venting, modulated furnace operation, aeration of furnace rooms, and heat transfer.
2. Objectives of the seven active research projects at three institutions have been briefly reviewed. These projects relate to heat transfer, corrosion, hot water from gas boilers, maximum comfort with gas heating, air distribution systems, draft control, and air supply methods for gas heating equipment in small rooms.
3. Three additional topics for future research being considered with special emphasis to be given to problems of venting have been listed.
4. General comments on the importance and necessity of gas house heating research as well as the value of the recent consolidation of three committees interested in heating and air conditioning into one group are included.

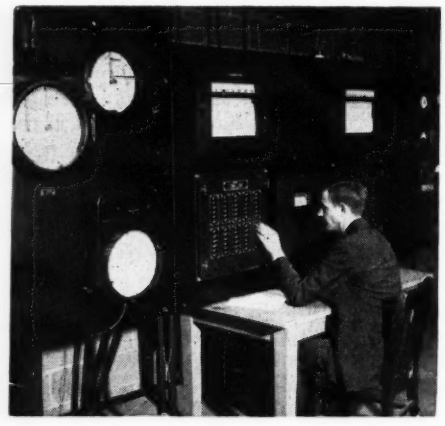
AT RIGHT, laboratory apparatus for box plenum tests in mechanical engineering department, University of Illinois. Distribution of air to the outlets, flow pattern inside plenum, pressure losses are tested.

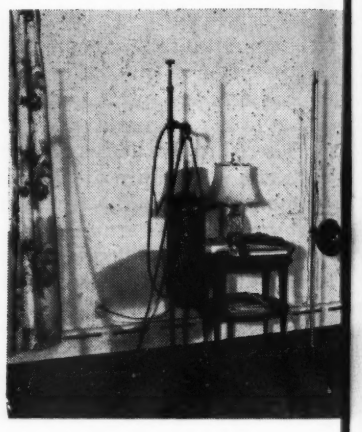


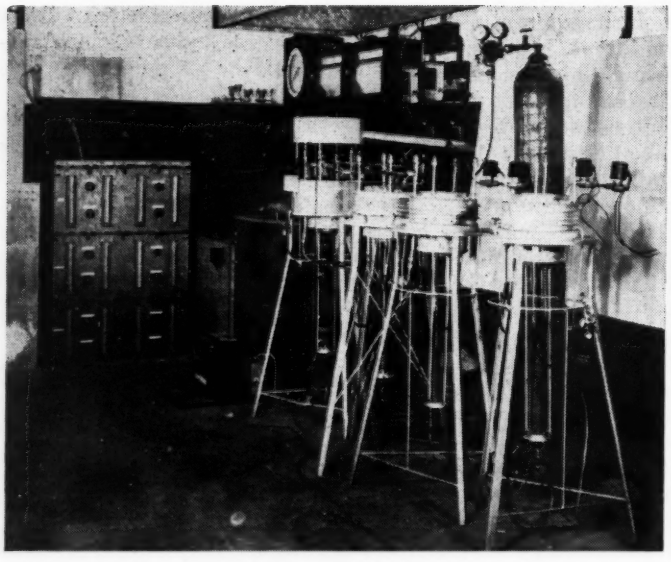
BELOW, one of the test setups at AGA laboratories for determining air requirements for a furnace installed in small closet. Furnace door is closed during test.



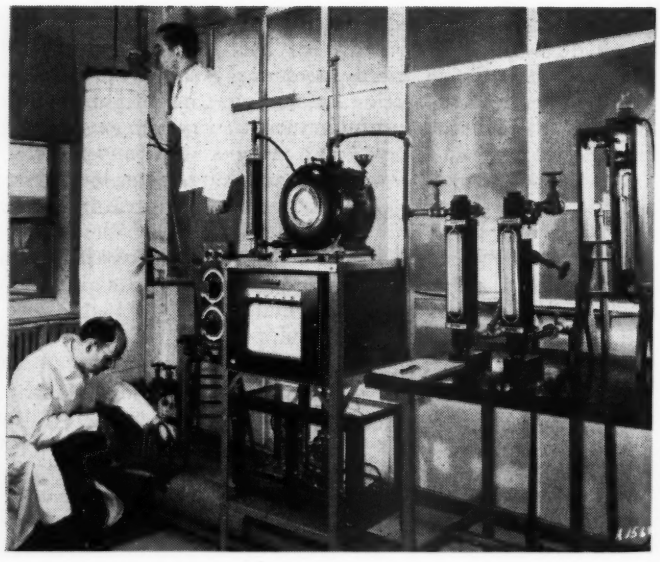
BELOW, LEFT, is instrument panel in No. 2 warm air heating research residence, University of Illinois. House is occupied, tests are made under normal living conditions. BELOW, RIGHT, living room of IBR research home, Urbana, Ill. In foreground, pipe stand supports thermocouples, recording bulbs. Cylinder and sphere measure comfort conditions.



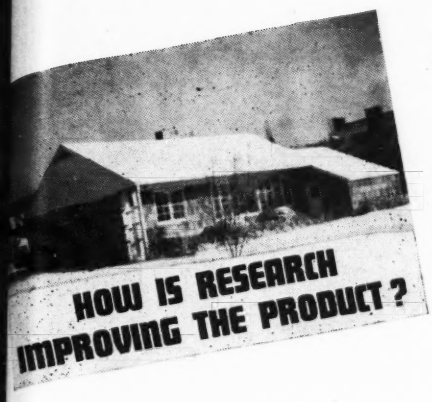




CORROSION TEST UNITS are shown in foreground above, in Battelle Memorial Institute lab. Relay and switch panel is shown at left, flowmeter panel in left center, and sulfur dioxide cylinder in background.



HEAT TRANSFER equipment employed at AGA laboratories. Vertical furnace is shown at left, air supply at bottom, air metering devices at right, temperature recorder in center, below gas meter.



2. University of Illinois Gas Househeating Investigation

By S. Konzo

HEATING research, like any other form of research in this rapidly changing world, moves with the times. This is as true at the University of Illinois as it is at other institutions and laboratories. Approximately 35 years ago when A. C. Willard and L. A. Harding started their initial investigations in the thermal conductivity of building materials, the questions of prime importance were those relating to the factors entering into the heat losses from building. From a modest start in terms of appropriations and personnel, the natural development under the guidance of A. C. Willard and A. P. Kratz has led to the present-day staff carrying on a widely diversified program both in the laboratory and in the research residences.

Exclusive

Although the several research residences have been widely publicized, the work is not confined to the residences. In this short summary an attempt will be made to enumerate some of the projects now in force, as well as the trends of the research investigations.

Cooperative Work

Ever since 1918 a cooperative research agreement has existed between the National Warm Air Heating and Air Conditioning Assn. and the engineering experiment station of the university. In many respects this research program is a unique enterprise in that a group of manufacturers have pooled their resources to find the ways to achieve higher standards of performance and better ways of doing their job.

In the beginning the work was necessarily confined to studies of basic performance of furnaces. In 1924 the first full-scale, completely equipped research residence was built; it was used for testing purposes for nearly 20 years. Out of these long-term tests came a realization that improvements in furnaces and the component equipment were not enough, but that actual field performance of a heating plant was dependent upon a number of factors that were not recognized up to that time. Since 1944, four additional research residences have been built, of which two were built from funds furnished by the warm air association.

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Residence No. 2

By 1940, because of the rising cost of construction, the large 2½-story house was too costly to build. Hence, in 1945 Residence No. 1 was sold and the proceeds used to build a residence along more modern lines. This Research Residence No. 2 was a one-story bungalow type structure of good construction. This structure, which incorporates a full basement, was built in such a fashion that a wide variety of types of warm air heating systems could be tested. The walls and ceiling panels are removable, and alternate register locations can be provided. An active test program was begun in 1946.

During the past few years tests have been made on a warm air ceiling panel system, as well as on the more conventional forced-air system using high sidewall registers. Other tests have been made on the effects of adjusting the control settings and the fan speeds. Still others are contemplated on such items as the effects of introducing outside air, the methods of ventilating a closet-type gas-fired furnace, and the effects of sun and wind on overall plant performance. The progress reports on these projects are made to the sponsoring agencies, and in due course of time will be released for general distribution.

In 1949 the association set up a committee, headed by C. W. Nessell of Chicago, to make field surveys on short-term bases of a large number of post-war homes. The post-war home turned out to be a smaller and less pretentious affair than was anticipated before 1945. In fact, in many respects the mass market for homes tended toward minimum acceptable standards of size, construction, and equipment rather than the optimum. The practice of building homes without basements, and particularly on a flat slab of concrete laid on the ground, extended northwards into the colder zones.

This change in construction introduced new problems that had to be met. Out of this survey it became apparent that one type of warm air heating system deserved further study. In 1949, therefore, Research Residence No. 3 was built by the association to simulate prevailing low-cost construction practice. The house that was built is not pretentious; the sidewalls are not insulated simply because many homes of this class are not so protected; a slab floor was used; storm sash were omitted purposely; in all respects therefore the house is a representative sample of that which can be found by the thousands all over the country.

Floor System

The innovation that was tried in this residence was to install a perimeter warm-air heating system in the floor. In this installation the heated air from the furnace is discharged into a concrete pit below the floor. The air is then led from the pit to a galvanized-iron duct running around the perimeter of the house and below the floor. In each room of the house registers are placed in the floor so that the air can be discharged into the room. This interesting system is being tested and will be compared with more conventional approaches.

The work in the laboratory is maintained. Frequently the experience in the research residences will indicate that a more detailed study of some part of the system is desirable. In this case the problem will be taken into the laboratory where the conditions can be controlled much better than they can be in the residences. The studies of this nature that have been conducted during the past few years have included: pressure loss characteristics of fittings used in an extended plenum, methods of testing blower-furnace combination units, and factors affecting distribution of heat to the various branches in a duct system.

The second major cooperative research project of long standing is that maintained with the Institute of Boiler and Radiator Manufacturers, a group of manufacturers who produce cast-iron boilers and radiation. The initial work for this project was conducted in a cold room in the laboratory. This cold room consists of a test room located within a cork-lined shell. The space between the inner and outer rooms can be maintained at a temperature of 0°F. A large number of tests were conducted in years past to determine radiator performance, effect of enclosures, radiation effects from radiators and convectors, and factors affecting instruments for measurement of comfort.

TWO-STORY I-B-R (Institute of Boiler and Radiator Manufacturers) research home on University of Illinois campus is furnished and equipped specifically for testing of steam and hot water systems. It is one of five field laboratories at Illinois for full-scale systems and controls. Tests are run all winter.

I-B-R Research Home

Later the I-B-R research home was constructed in Urbana for full-scale testing of the complete steam and hot water heating system under actual weather conditions. As in the case of the other residences, an extensive instrumentation is used which permits complete records of plant performance to be obtained over a wide variety of weather conditions. A great number of test series have been conducted in this research home including forced-hot-water systems, steam systems, baseboard radiators, and economy piping systems.

The systems which are installed in these research homes are evaluated from the standpoint of initial and operating costs and degree of comfort maintained. In view of the previous experience with the other residences it was no surprise that actual operating conditions maintained in a field installation did not necessarily agree with those assumed in the design of the systems. For example, in the design of any heating system one specific outdoor air temperature is assumed, and the piping sizes are determined for that condition, with no regard for such effects as time lag, heat regain from piping, boiler. vent pipe, and chimney, and weather effects.

In the actual operation of any home heating plant, these effects play a major role. Heat regains from piping, boiler jacket, and chimney, for instance, are not negligible in magnitude, so that under design weather conditions the fuel utilization is much more effective than that commonly assumed.

Two years ago the I-B-R project installed a baseboard radiator system in a low-cost, one-story prefabricated house built upon a concrete floor slab. The results were most encouraging and significant, in that the installation offers a heating method other than that of installing pipes in the floor for this type of structure.

Laboratory Work

The work in the laboratory is maintained and is devoted largely to the study of component parts, such as the frictional resistance of various types of hot-water fittings, the flow of steam in piping systems, performance of domestic hot water heaters, etc. In all work conducted in the laboratory no attempt is made to run comparative performance tests of commercial models, nor to run rating or certification tests. The object in all cases is to determine typical performance data that will enable the formulation of a more rational design procedure or testing code. In other words, the university does not rate, recommend, nor endorse any commercial product.

One of the many research projects sponsored by the American Gas Assn. is located at Illinois. This project, which falls within the province of the domestic gas research group, is devoted to a study of factors entering into all-year gas air conditioning.

Box Plenum Method

The first year of work was devoted to a study of the box plenum method of air distribution for an air conditioning system. The second year of work is being devoted to the extended plenum type of air distribution. The reason for this emphasis on the distribution duct system becomes apparent when a cost analysis of a typical all-year air conditioning system is made. The cost of installation of the distribution system is a major part of the total cost, and any reduction in the total cost can be made most effectively if the distribution system is simplified.

Both the box plenum and the extended plenum types of air duct systems are far simpler than the conventional branch and trunk duct arrangement in common use. Since performance data regarding frictional losses and energy requirements were lacking for these two systems the laboratory experimental work has been devoted to a critical analysis of the losses. The results obtained from the project are disseminated from the office of AGA.

Another phase of the project is devoted to a critical analysis of factors affecting the design, operation, and adjustment of all-year air conditioning systems. This is primarily a study of the literature bearing on the subject, and an evaluation of the most important factors that determine whether an all-year air conditioning system will operate satisfactorily.

Floor Slab Lab

In cooperation with the Small Homes Council of the University of Illinois, the department of mechanical engineering has utilized the facilities provided by a unique building that bears the designation of "floor slab laboratory." This also is a field testing building of unusual design. A long, narrow building with no windows has been built so that studies of the thermal characteristics of floor slabs can be made. During the first year of operation a large number of different types of floor slab constructions were tested in the building. In all cases no heat was supplied directly to the floor slab, and convection heaters were used throughout. The results obtained indicated the necessity of adequately insulating the edges of the floor slabs not only to minimize the heat loss to the outdoors and the ground, but also to improve the floor surface temperatures on that portion of the floor slab near the exterior cold walls.

During the present year a perimeter warm-air heating duct has been placed below the floor and near the exterior wall. A careful analysis is being made of the manner in which the heat is dissipated from the heated duct to the room and to the outdoors. The results obtained in this laboratory are being compared with those obtained in Research Residence No. 3.

Gravity Research

Also available to the mechanical engineering department is a small one-story bungalow built by the Small Homes Council, which has been in use for study of gravity warm-air heating systems. The duct system installed in this residence was an extended plenum with horizontal branch ducts which provided maximum head room. The design of the system was based upon laboratory results, and the operation of the plant was found to be satisfactory, in spite of the fact that the duct system deviated considerably from common practice.

Research itself is not sufficient. The dissemination of the results and the application to field practice requires that the research engineer should lay down his instruments and spend some time and effort translating the technical information into usable form by the industry. This was done initially by the National Warm Air Heating and Air Conditioning Assn. by means of manuals which were prepared specifically for the heating contractors. At the present time approximately 10 different manuals are available from the Cleveland office of the association. These cover a wide range of topics from "Heat Loss Calculations" to "Perimeter Warm Air Heating."

The approach in general is one which gives a step-by-step procedure for the design of the various types of heating systems. Along with the manuals a complete set of work sheets was also prepared. These manuals form the textbooks for the numerous three-day short courses being conducted throughout the country by Guy Voorhees, educational director of the association, as well as for the short courses conducted at three midwestern universities.

A similar program involving the preparation of design codes and the holding of short courses has been followed by the Institute of Boiler and Radiator Manufacturers. This type of educational activity is hardly within the category of research, but is a necessary one for rapid advancement of field practices.

Small Homes Council

The Small Homes Council of the University of Illinois has for several years provided an informational service to the building industry and to the homeowners of the state and the country. Part of the research results from the heating experiments have been included in a number of simple circulars that were written specifically for the homeowners. Here again the research staff provided the information, which was translated into the simplest terms.

A number of members of the staff are engaged in teaching both at the undergraduate and the graduate level. The university does not offer a specialized training in heating and air conditioning. However, heating and air conditioning are included in the curriculum of the mechanical engineering department, as well as other basic subjects such as heat transfer, fluid flow, thermodynamics, combustion, and power equipment.

Contrary to popular belief, the students whose interests lie in this area are not subjected to detailed study of any one system, nor do they do too much in layout, routine testing, repairing, or servicing. The emphasis has been concentrated largely on the basic fundamentals of the art. This is especially true at the graduate level where the students are subjected to current-day problems and new developments and where the answers are not known either to the student or the instructor.

Naturally many problems in the field are of a type that lends itself to strictly analytical study, whether it be heat gain of ducts or flue gas losses for varying values of CO_2 and flue gas temperatures. Some of these analytical problems require only pencil, paper, and slide rule, but they may involve just as much research as a purely experimental problem. Graduate students are encouraged to select their own problems and many such studies have been made on a wide variety of topics.

The Medical Side

The work in physiology and medicine is being conducted by the College of Medicine of the University of Illinois. These studies involve careful determinations of the reactions of human beings subjected to wide ranges of temperature, humidity, air pressure, and air cleanliness. Out of these basic studies of what makes a human being tick may come certain guides to optimum temperatures, humidities and air properties for the air conditioning engineer.

As indicated earlier, the initial impetus towards heating, ventilating, air conditioning, and refrigeration was given by Prof. A. C. Willard. Since his retirement, the work has been carried on by a staff of 17 members of the research and instructional corps of the department of mechanical engineering, not counting the several investigators at the medical school. Several graduate students devote part of their time in experimental research under the direction of the staff members. The technical results of the research work are presented in the bulletins of the engineering experiment station and in the papers of the American Society of Heating and Ventilating Engineers.

Summary

This brief description of the many ramifications of the university's heating research demonstrate that a number of parallel activities are carried on by the staff. Some of the activities are purely instructional and some are frankly developmental type research work. The objective of the department has been, however, to lift the profession's methods as rapidly as possible from the rule-of-thumb empirical attack to a more rational technical approach.

In the future even greater emphasis will be placed on the fundamentals of the various sciences involved in heating and air conditioning. A great deal remains to be uncovered in such realms as soil thermal characteristics, combustion problems, solar heating, heat conductivity of materials, and weather studies. Perhaps some contributions can be made in these as well as in other fields.

Codes and Ordinances: The Industry Should Watch Them Closely

Whenever an industry fails to take the lead in promoting its own regulations for the benefit of the consumer, government steps in, says Mr. Payne, who discusses in this article some current developments in the revision of heating codes and some of the thinking behind them.

By HENRY B. PAYNE

IT is of utmost importance that the heating industry consider carefully every indication of a need for regulation. Then, it must be prepared to take a full part in code and ordinance work. History has proved only too clearly the fact that if an industry does not take an active part and interest in formulating adequate regulations, then the municipal, state, and federal governments eventually step in and do the job by themselves. A good example of this is found in a recent bulletin from one of the area offices of the Federal Housing Administration regarding the installation of gravity warm air heaters on the same floor level as the heating unit and having supply outlets near or in the ceiling. This bulletin requires that any new home which is to receive FHA financing and which will have such a heating unit installed must have a grille provided near the ceiling to assist in the circulation of heated air from the hall to other rooms. Furthermore, it was ordered that thermostatic control be provided in all cases and that ceiling insulation equivalent to 2 in. of mineral wool be provided.

Exclusive

This situation must not be confused with the practice, now existent in many professions, of continually asking so many questions about technical matters from governmental agencies that those agencies are actually encouraged to write more regulations. Too many of us try to use the codes and ordinances as a crutch to avoid making a decision as to what is good engineering practice, in the very few opportunities which do remain. Some people start out by calling the most logical governing agency and asking if there are any rules pertaining to a new situation which has arisen. This type of action stimulates governmental code-writing activities. If these people would develop the ability to take a stand and decide from adequate experience just what the particular specification should be, this situation would be rectified.

Heating codes of any description should meet the following general requirements.

1. They should be flexible enough to permit the use of new materials and equipment provided they can be proved safe.
2. They should definitely specify what shall or shall not be done and should avoid any reference to procedure or the manner in which the work is to be done.
3. They should be practical from the standpoint of trade and should include only those terms and measurements which are clearly understood by the men who install the equipment.
4. They should be as specific and as clear as it is possible to make them, and should not contain vague phrases which leave much to the discretion of the inspector.

Thus, it is seen that it is necessary to provide uniform regulations which will not be outdated by progress in the heating field. Emphasis should be placed on the results to be obtained, and care must be taken to see that the methods of obtaining such results are not so limited that the ingenuity of the designer and his interest in keeping his systems up-to-date will be impaired.

We must also remember the one and only reason for having codes and ordinances. That reason, of course, is the public health and safety. In the southwestern part of the country, it has been proven bad practice for the utility company to try to police local regulations. Where this has been done, the utility company has actually entered the province of the building and safety departments of the cities and counties. This has resulted in much justifiable criticism against the utility by reason of its having increased the amount of overlapping jurisdiction.

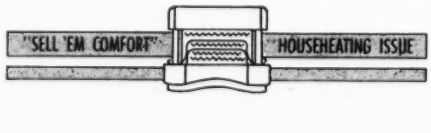
People moving to the Southwest from the East often expect the utility company to enforce many of the provisions of the plumbing and heating and ventilating codes. This feeling results from the fact that in the eastern part of the country the gas utility companies do most of the gas fitting. The plumbing ordinances of many eastern cities do not even contain the words "gas fitter," nor does the plumber do much gas piping.

The principle trends in all types of regulations affecting the heating industry are to be found in the following fields:

1. Heating codes and ordinances.
2. Fire prevention regulations.
3. Regulations in related fields.

Heating Codes and Ordinances

Many heating codes are being revised at the present time. One of the principal subjects being scrutinized is the mandatory venting of all heating equipment. One city in the Los Angeles metropolitan area recently passed an amendment to a plumbing code which requires that all heating equipment in all occupancies be vented. Such an ordinance raises one big question: how is it to be enforced? It is certainly clearly understood that a



metropolitan area having a very mild climate and using thousands of pieces of unvented heating equipment would have great difficulty in policing such an ordinance.

The only way out, from the city's standpoint, and the only way which would make the ordinance clearly enforceable, would be to require the venting of all heating equipment in new construction and then to require a flue or vent over every gas outlet in every structure. This also, of course, raises questions of legality.

The treatment of the subject of venting by those preparing ordinances should be watched carefully. Heating can be a very controversial subject and as such gives rise to many popular fallacies. The principal fallacy is that venting solves all of the problems of a faulty heating appliance. It is not generally known, for instance, that a vented heater will require twice as much fresh air as will the same size appliance without a vent. One jurisdiction recently ruled that only vented heaters were to be used in motels. It was sincerely believed that this would automatically solve the occasional asphyxiation which was occurring in these transient quarters. It is now reported from this same area that there has been no change in the rate of fatalities. In other words, an inadequate venting job is as bad as no vent at all.

Reasons for Venting

The only two reasons for venting appliances are safety and the removal of water vapor content from the products of combustion. The importance of complete knowledge of the venting process is related integrally to these facts, as is disclosed in *Engineering Research Bulletin No. 103* of Purdue University. This report shows that any one of the following things which occur can cause faulty or completely ineffective venting.

1. Excessive losses from vents and flues.
2. Exterior wind pressures.
3. Frictional resistances.
4. Negative interior pressures.
5. Insufficient flue capacity.

The codes and ordinances which regulate the heating industry have many vital features. Many features are common to codes in all parts of the country. In addition, each geographic area will have one or two special considerations resulting from the needs in that particular area.

One very interesting feature of the Heating and Ventilating Code of the City of Los Angeles, which I will try to trace through from its earliest beginning, is that of the definite minimum sizing requirement for furnaces. This code is one of the very few in the U. S. that has any such requirement for residences. Los Angeles has had a heating code since 1928. This original code was established in response to a united demand on the part of the public, the utility companies, and certain segments of the heating industry. It had a very simple sizing formula based on a rule of thumb of so many Btu's per cu ft of occupied space in any residence. This first code regulated the construction, installation, and venting of warm air furnaces only. Approximately 10 years later a campaign was begun to promote the calculation of heat losses on a more exact basis than on straight cubic capacity method. This was the next natural step because of the great difference in heat losses between a room with three outside walls and many windows, and, say, a room with one outside wall and minimum window area.

As a result of these efforts, a simplified method of calculation was devised by an association of heating manufacturers and installers in the southern California area. This method took into consideration all of the various heat loss factors for the different types of construction found in that area. It was used to a great extent by the industry, but was never accepted for use in the heating and ventilating code.

A short time later a more comprehensive system was included in the code, when a section was added which directed that heat losses be figured on the system set forth in the guide book of the American Society of Heating and Ventilating Engineers.

Up to this time the greatest tightening up of heating installation standards had occurred when FHA set down its regulations and required vented heating equipment for betterment of resale values. This the bureau could do on houses whose construction it financed.

HENRY B. PAYNE is well qualified to comment on codes and ordinances. He is active in the Pacific Coast Building Officials conference, Western Plumbing Officials Assn., and Southern California Conference of Fire Prevention Inspectors.

A graduate of the University of Redlands (California), Mr. Payne is presenty ordinance bureau supervisor, Southern California Gas Co., Los Angeles.

At this time, there occurred the first volume installation of floor furnaces. But, because of the tremendous growth of the area, there were also hundreds of thousands of unvented room heaters in existence. Even at the present time it is estimated that there are more than 750,000 unvented room heaters being used in southern California. These heaters have a good record because of the mild climate, the type of construction which is prevalent, and the service policies of the gas utility companies. There is still a need for the upgrading of some types of heaters but it should not be attempted overnight. Consideration must be given to the people who can afford room heaters and who perhaps could not pay for a vented heating system—or even a new vented heater. We must be ready also to answer the persons who think that venting is the answer to all the troubles that exist in the heating field.

Los Angeles Code

At the present time the minimum heating requirement of the city of Los Angeles is not included in any other municipal code in the state of California. It is a requirement specifying the minimum Btu rating of warm air furnaces and warm air heaters serving rooms used for living and sleeping purposes. The requirement is limited to those rooms in which a warm air outlet is located. This code provision, therefore, includes residence and living quarters in apartment houses and hotels. Heating equipment in other types of buildings is usually designed by a consulting engineer and the requirements of such buildings are so varied that no attempt is made to regulate capacities.

There has been much thought regarding the legality of this sizing requirement. It has been in effect for several years now and seems fairly well established, however.

One of the major committees of the Pacific Coast Building Officials conference is that on chimneys, vents, and heating appliances. One change being considered by this committee would require a heat loss calculation calling for a minimum amount of heating for every house having heating equipment. If any such requirement were accepted by this conference, it would have far reaching effects because the uniform building code is in effect in more than 500 cities throughout the U. S.

The first such minimum heating requirement on record occurred in the Midwest. It came about as a result of studies conducted by a city health department in tracing epidemics of influenza. It was believed by city officials that epidemics of this kind were minimized in areas where the homes and

offices had adequate heating. Since the issue was one of health and safety, it became possible to include it in the heating code.

The objections to the heat loss requirement are numerous. It is pointed out, for instance, that it should not be mandatory for a family to have to install a certain amount of heat when that family may not be able to pay the price for that heating system. Many people are warm-blooded and require very little heat in most living spaces in homes in the southwestern part of the country. In the extreme, it is believed by some that the heat requirement is as unreasonable and basically as unsound as if a city were to require, for health's sake, that every home owner have a mechanical refrigerator, in order that bacteria growth in food and the resultant illness might be prevented.

On the other side of the picture are various illustrations of the thinking which has contributed to the development of this requirement. One which partially applies is that on the subject of water pipe sizing. One of the reasons for certain definite sizing of water pipes in a code is to insure an adequate supply of water quickly in order to provide minimum safeguards to health.

Protecting Buyers

We must also think of the effect on the people who decide to buy a house which has warm air registers in each room. It is the position of many competent persons in the industry that a person should have the right to expect an adequate amount of heat to be available where such registers are in existence. Heating appliances are sometimes so undersized that the home owner drills out the burner orifices in his efforts to get more heat from that appliance. This results in overgassing of the appliance and an excessive percentage of carbon monoxide in the products of combustion.

The actual wording of such a heating requirement in a code does not vary a great deal between the few jurisdictions that now require it. Two examples of such a requirement are given below.

The City of Los Angeles Heating and Ventilating Code says that:

> The approved Btu output rating of every warm air furnace and warm air heater serving any room or rooms used for living or sleeping purposes *shall not be less than* the theoretical Btu rating necessary to maintain a difference of 40°F between the air temperature in such room or rooms and the outdoor temperature.

The State of Indiana's Heating, Ventilating, and Air Conditioning Rules and Regulations, Volume IV, word their heat calculation section as follows:

> Adequate and appropriate heating systems shall be provided, maintained, and operated for all occupied areas within the scope of these rules and regulations. The following winter inside dry bulb temperatures shall be considered as a minimum. . .

These point out that there is little difference in the wording of this requirement at the present time. Illustrations of the wide divergence of requirements found in other sections of the code appear in the same Purdue University bulletin previously mentioned. For instance, it is found that the conditions requiring venting of a room heater vary in the following extremes:

1. Capacity minimums for non-vented heater installations—from 40 sq ft of floor space to 1000 sq ft.
2. Range of values for heater capacity as a condition of venting — from 30,000 to 75,000 Btu/hr.
3. Gas consumption as maximum values for unvented heaters—from 15 to 25 cu ft/hr; and gas consumption as a limiting factor, expressing the maximum condition for unvented heaters—30 Btu per hr per cu ft of room space.

Similarly, requirements on the materials to be used in vent pipe construction vary in the following extremes:

1. Some codes were flexible, indicating only that material should be non-combustible and non-corrosive.
2. Metal pipes were permitted in rare instances.
3. A few codes indicated approval of double metal-wall pipe in which the annular space either was filled with insulation or contained dead air.

It is of interest to note that the heating regulations of the Federal Housing Administration are also being scrutinized at this time with the definite possibility that some long-established rules may be changed. It has long been established that the calculation of heat loss from heated space into adjacent spaces such as attics and basement areas is to be based on the assumption that the temperature of such adjacent spaces is 15°F above the outside design temperature. It is now thought that the temperature to be assumed for such adjacent spaces might better be the same as the outside temperature.

Also, it has been established for some time that the infiltration heat loss shall be calculated as the heat required to raise the temperature of an amount of air equal to the cubical contents of all the heated space in the dwelling from the outside design temperature to the inside design temperature in one hour. A figure of two air changes per hr is now being seriously considered in contrast to the above regulation.

The capacity of overflow heating equipment such as pipeless furnaces may now be based on a definite number of Btu's per sq ft for certain outside design temperatures. It is now thought by some authorities that this rule of thumb alternate should be discontinued. Also, the heat allowance now being made for a fireplace may also be discontinued, and the 18-ft maximum distance now allowed between a heater and any room heated by it may be reduced to 15 ft.

Fire Prevention Regulations

Fire prevention regulations affect the heating industry considerably. The major emphasis now given to such fire prevention subjects appears to have originated from two sources. The first and largest is the action program adopted in Washington in May 1947 by the President's Conference on Fire Prevention. Called as a result of the Atlanta and Chicago hotel disasters, this conference urged acceptance on the part of public officials of greater responsibility for fire safety and wider public support for all measures dealing with fire prevention. The recommendations made were in the fields of law enforcement, building construction, fire fighting services, fire prevention education, and research.

In the Los Angeles area, the great impetus was received following a serious plating works explosion. Now, the fire chief of the City of Los Angeles and the chiefs in several other cities have wide and flexible authority to write regulations affecting the heating industry. One of these is the Dangerous Chemicals code being proposed by the fire department of the City of Los Angeles. This code goes far beyond what one would normally expect to find in a chemical code, because it includes statements regulating the minimum distance of valves in gas main piping, a statement of the frequency of leakage surveys, and a maximum time allowance for response to a break in a gas main.

The proposed revisions to Title 19 of the California Administratvie code, which are the rules and regulations of the state fire marshal, involve gas appliances to a greater degree than ever before. These regulations in general govern any hospital, jail, school, institution for the aged, or any place of public assemblage where 50 or more persons may congregate. The proposed regulations include the venting of all new heating equipment, the regulation of heating and cooking appliances by the standard fire prevention practices of the National Board of Fire Underwriters, and the stringent regulation of liquefied petroleum gas-fired appliances.

Regulations in Related Fields

Another major subject to be discussed is that of kitchen ventilation. At the present time, the uniform building code requires the ventilation of every kitchen. The City of Los Angeles, at the present time, requires ventilation of only those kitchens having gas ranges. As a result, there is a proposed amendment submitted which would require ventilation over the cooking facilities in every kitchen.

The problems resulting from the conflict between these two codes can be illustrated as follows. In the construction of a new residence, where other than a gas range is to be installed by the owner, there is no city requirement for kitchen ventilation under the present wording. If the home is sold at some future time and the new owner wants to install a modern gas range, the inconvenience and extra expense to be incurred by providing ventilation at that time would certainly be a hardship and probably would not be done, especially since the code is not retroactive in that respect.

Appliance dealers in the city are selling an ever-increasing volume of gas ranges in homes which previously had ranges using another fuel. This is a natural, continuing trend. When a family moves to a new location, market analysis figures show that the chances are heavily in favor of a gas range being installed. As a typical example, the city's Wyvernwood housing project has installed modern gas ranges in 300 apartments, replacing the type originally installed. Gas ranges are being installed in the remaining units whenever tenants move. Eventually there could be 1100 gas ranges in this project.

Kitchen Ventilation

A statement of the situation is to be found in the *Data Book on Gas Utilization* prepared under the supervision of H. Roy Kelley, AIA, which says:

> Approved gas ranges will operate satisfactorily without a vent and many of the newer ranges have no provision for vents. The modern insulated oven heats so rapidly and maintains its temperature with such a small flame that venting serves no useful purpose. No kitchen should be without some form of positive ventilation to carry off steam from top burner operations and cooking odors.

A similar reference to the subject is found in the remarks of Carl H. Dean, who has said, "We know that ranges and refrigerators do not use enough gas to require venting. We also know that every kitchen requires ventilation regardless of the type of equipment used."

The field of heating regulations also includes the major subject of ordinances regarding the qualification of workmen. It becomes necessary in many communities to set forth rules and regulations with which contractors and installers must comply. This, too, has its basis in safety for the public by assuring that well-trained people are installing heating equipment. This particular type of requirement has developed in some localities to the point where both the city and state require contractor's licenses in a particular field. This procedure now has been challenged in at least two cities and local courts have denied the right of cities to require examinations for contractors where the contractors have already been licensed by the state. Two of these decisions have been upheld by District Courts of Appeal. As a result, the Plumbing division of the City of Los Angeles has issued the following information in an official bulletin.

> . . . the department . . . will issue plumbing permits to any person who holds a valid state plumbing contractor's license.

All of these trends indicate that people are not afraid to try new things—new materials, and new design of equipment. With new methods come new regulations. Many an industry has had to ask for a set of regulations, well administered, because high insurance rates have held down industrial expansion.

Within the scope of this material can be found wide variations of authority and of the methods by which it is granted. On one extreme is found a governmental agency which is empowered to write all regulations which it deems necessary. In other branches of the same government, such an expression of authority would never be allowed and all regulations would have to be adopted by statute. Perhaps heating ordinances and regulations in your area are not developing at the same rate as has been described here. If they are not they may be soon. Plan to get in on the ground floor of their development. Contact those organizations which can influence heating legislation. It pays.

AGA Sets New Closet Heater Requirement

HEATING one's house with a "packaged" gas-fired furnace which can be tucked away in a closet or alcove where it will require very little space calls for equipment approved for the purpose and careful installation, according to the American Gas Assn.

For safety, certain rules and regulations have been formulated by the association, which for the first time is now approving units for confined space installations.

The units in addition to displaying the Laboratories approval seal, showing that they have been tested and approved under American Standard approval requirements, must be specifically labeled for closet or alcove type installations, showing the permitted wall clearances for which they are approved.

Confined space units are approved for installation at various clearances. These are for flush-to-wall or "zero clearance" and for clearances of 1, 2, 3 or 6 in. from walls. The draft hood of the appliance, however, must be kept at least 6 in. from walls and ceilings in all cases. The unit must also be labeled for the type of floor for which it is approved, whether combustible or noncombustible. Manufacturers may submit appliances for either alcove or closet type approvals at any of the designated clearances.

In addition to the use of an approved appliance, provision of an adequate air supply is of major importance. Air openings to the enclosure should not only be adequate, but so arranged that they are not easily blocked by furniture or household articles.

Air is needed for three purposes: for proper combustion of the gas by the burners, for ventilation of the confined space itself, and for circulation through the furnace for warming the house.

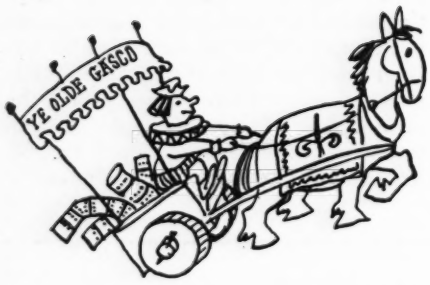
Combustion and ventilating air should be provided by two openings or registers to the confined space in which the furnace is located. The first, an inlet, should be about 6 in. from the floor and the second, an outlet, about the same height from the ceiling.

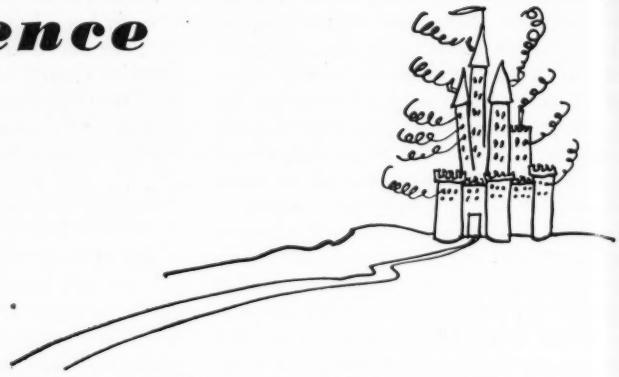
Proper opening size for satisfactory burner operation and ventilation of the confined space is 1 sq in. of actual free opening for each 1000 Btu gas input rating shown on the furnace nameplate. If the building is unusually tight, so that normal air infiltration into the house is low, air should be obtained from outside or from spaces freely communicating with the outdoors such as a crawl space or attic by the use of ducts. This is because the air used for combustion is discharged out the chimney and must be replaced.

Air for circulation through the furnace proper, warming the house, should be kept separate from ventilating and combustion air to the enclosure. A duct directly connecting the furnace to some point outside the enclosure should always be used. This can connect to an adjoining room or hallway.

Installation should be in accordance with the association's new standards for installation of gas appliances in buildings which outline the detailed manner in which good installations should be made.

Is The Science Of Venting





In The Dark Ages?

Exclusive

By Carl H. Dean

PERHAPS a more accurate title for this article would be "Are The Principles of Adequate Venting Still Being Ignored?" In which case the answer would have to be, "In many cases, *yes!* But the picture is very encouraging when compared with 10 years ago."

Scientific principles do not change. Applications of these principles do change. New developments in construction, new appliances and applications of these appliances bring new problems which require special treatment, but the basic combustion requirements must be met for satisfactory operation of gas heating equipment.

Chief among these requirements is a constant, adequate supply of air to furnish the oxygen required for combustion and to remove the products of combustion from the occupied space. There was no problem about air supply in the speculative construction which preceded the advent of FHA. But with limitations on the hourly Btu loss and consequent increase in the use of weatherstripping, sheathing, insulation, etc., accompanied by a reduction of cubic content per person, due to ever increasing building costs, there came into existence an actual shortage of air in the home sufficient in many cases to create measurable negative pressures in the home from which it is difficult to remove the products of gas combustion.

Since a large portion of these products consists of water vapor and much of the new construction includes vapor seals, the normal humidity build-up within the home is aggravated nearly 100% at times and the consequent condensation within the walls becomes very destructive.

AGA early became aware of the seriousness of the situation and the fact that gas was being made the scapegoat in many cases where it could not be wholly to blame for the conditions. Being cognizant of the fact that any research findings of the organization's own laboratories would be suspected, they called in an outside research authority which had the advantage of being in touch with the problem. The Purdue Research Foundation was already conducting research for the prefabricated home industry and was well aware of the existence of condensation in homes which did *not* use gas. Prof. J. L. Bray was given charge of the program and C. E. Blome, research associate, conducted the nationwide investigation of conditions which formed the basis of the first report, which was Engineering Bulletin of Purdue University, Research Series No. 103,* The Engineering Experiment Station of Purdue University.

This report is very realistic and profusely illustrated, showing that much of the trouble being experienced is the result of ignoring even the most elementary rules of venting. Recognizing good work which had already been done, this report is based largely on John C. Mueller's work "Gas Appliance Venting," given at the 21st gas school and conference at Ames, Iowa, and findings uncovered on an extensive field investigation. In addition to the six rules given by Mr. Mueller, a seventh rule which covers an important point responsible for a great number of venting installation failures is given:

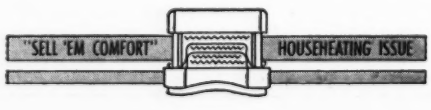
"Rule 7. Provision for an adequate and continuous supply of oxygen for combustion and air for vent operation (draft hood dilution) must be made or negative interior pressures and less than 100% effective venting will result."

The report is summed up in six general observations which bear repeating.

1. A venting problem does exist in each of the six geographical areas of the U. S.
2. Successful solution of the venting problem has been obtained in various cities of at least four areas. The solutions were accomplished by two methods of approach: compulsion and cooperation.
3. The causes of vent failures were divided into seven classifications, the most serious of which were excessive thermal losses and exterior wind pressures.
4. Construction practices vary widely throughout the United States. There are no codified specifications accepted as standard venting practices for the entire country.
5. Too few specifiers and installers of gas-fired equipment, irrespective of whether they are architects, engineers, dealers, servicemen, plumbers, sheet-metal workers, furnacemen, or just plain "jacks-of-all-trades," understand and practice the principles of "good venting."
6. Considerable education and inducement will be required to re-educate the above group to insure correct vent installation practices.

A copy of this bulletin should be in the hands of anyone who is vexed by modern problems of venting gas appliances. We use the term "modern" advisedly because the problem keeps changing with other developments in building construction which may seem to be only distantly related to the subject. Whenever any new appliance or any change in construction has anything to do with air, we must check to

*Published for the AGA as Bulletin No. 103, *Research in Venting Direct Gas Heaters When No Chimney Connections Are Available.*



see what effect there will be on the venting installation, which after all consists of only three items, the vent pipe from the draft diverter, the vertical flue, and *air*.

The 1948 "Heating, Ventilating, Air Conditioning Guide," published by the American Society of Heating and Ventilating Engineers, states on page 155: "Infiltration in residences normally supplies the air required for combustion by fuel burning appliances, but in some residences weatherstripping, sealing and caulking may reduce infiltration to the point that special openings must be provided to supply air to heating appliances."

If this is true, consider how important it is to protect the venting installation from devices which may be installed by the owner, such as kitchen exhaust fans, wood burning fireplaces and other gas fired appliances all of which require air and may create a negative pressure area in the home sufficient to reverse the action of the flue serving the heating installation. When this happens, regardless of any other features of construction, the house is bound to sweat in normal heating weather and under severe conditions it goes beyond the nuisance stage to become a positive menace to the property. We will not dwell on the hazard to the occupants if the appliance is out of adjustment or the shortage of oxygen becomes great enough that incomplete combustion results.

It follows that the installer of gas equipment venting must be a bit of a prognosticator. He must not only consider what the conditions are under which the equipment will operate, but he must indulge in a modicum of fortune telling to provide for what the conditions can be. It is obvious that if there is scarcely enough air present for correct operation of the heating equipment, any additional demands set up by other equipment, such as kitchen exhaust fans, wood burning fireplaces, and other air consuming equipment, will create a negative pressure area from which it is impossible to adequately vent the heating equipment. So the air supply for the equipment room, utility room, or basement where the heating equipment is installed must have an unobstructed passage from the source. The door to such a room should be tight and there should be no openings in such a room connecting with the living quarters of the occupants.

The list of things which should not be done is endless, and careless installers apparently think up new items every day. We must stop thinking of gas as a vapor and consider it as a fuel, which it is, and must treat it as such. It is a trite saying that "It is not the use of gas but the abuse of gas which causes trouble." Its very cleanliness and its combustion

CARL H. DEAN, author of this article, has almost 30 years of practical work in venting. His experience includes 10 years as a heating-air conditioning contractor in Tulsa, 12 years as heating engineer of Oklahoma Natural Gas Co., two years as director of education for Heating Research Corp. He is at present a member of the domestic heating division, Stewart-Warner.

products lead to its abuse. The rules for venting combustion products of any fuel apply in a degree to gas. The science of venting is not an exact one, but is constantly being developed as new problems are revealed by new methods of construction. Gas has the advantage, which sometimes is a handicap, that the products of complete combustion are obnoxious to none of the senses as are the products of combustion of other fuels. As a result, many inadequate installations escape detection until the damage is done.

Progress Means Trouble

The designer of venting installations must keep abreast of all developments which can affect his installation and, if possible, anticipate them. Few men are having a more permanent mark on this age than is "Boss" Kettering of General Motors, and certainly no one is less sympathetic to alibis than he. Yet we derive much consolation in rough periods from his statement, "The price of progress is *trouble*. Nothing new ever turns out just right. You just keep fixing it here and fixing it there until it works pretty well." Certainly this quotation applies to venting the products of gas combustion, a problem we will have with us as long as gas is used.

One of the complications faced by the industry is the multiplicity of codes and ordinances which are usually written like the "laws of the Medes and Persians which change not," or edicts handed down from Mt. Sinai. The industry must pay more attention to these rules and participate in their enactment, at least to the extent of seeing that provision is made for revision as new equipment is made available or new problems are presented by changes in construction methods.

There has been a great change in the domestic fuel markets in recent years. Gas is no longer considered to be a luxury fuel. It is the much-to-be-desired standard. No longer do we stand, hat in hand, begging for recognition. We are in position to demand cooperation to the extent of intelligent utilization, which certainly includes proper venting.

There are actually only three parts to a venting installation and the first one is *air*. Air for combustion, air for the draft diverter, and then excess air. Purdue Research Foundation recommends a supply of 25 cu ft of air for each 1000 Btu input of a vented type gas appliance. The other two parts of the venting installation are the vertical portion known as the chimney, or flue, and the lateral vent pipe leading from the appliance draft diverter to the flue.

Four Future Causes

In a nation-wide survey of existing conditions, conducted by Purdue Research Foundation, as a part of a research project for AGA, it was found that failures of venting installations were caused by (1) excessive thermal losses from vents and flues, (2) exterior wind pressures, (3) frictional resistances, (4) negative interior pressures. These four comprise nearly 90% of the causes of failures. Insufficient flue capacity was responsible in about 5% of the cases, while blocked flue, broken vents, and flues come under the head of maintenance rather than design. We can expect to have more and more trouble with our venting from negative interior pressure areas. This is a natural result of the reduction in cubic contents of the houses per person due to increased construction costs and the sealing of these houses to reduce infiltration heat loss.

Excessive thermal losses from vents and flues usually result from either extreme lengths of the lateral portion of the venting installation in unheated portions of the structure or a partially exposed vertical flue. Masonry chimneys are not fit for the use of domestic gas appliances when an entire side of the chimney is exposed to the weather or an unheated portion of the building, such as a garage. Such chimneys are cold flues and, with thermostat-controlled heating installations connected thereto, will cause excessive spillage of flue products at the draft diverter every time the thermostat calls for heat and full capacity of the appliance is turned into a cold flue.

"Type B vent material should not be used for external chimney flues and external runs of it should not exceed 3 ft outside the building roof. When this requirement makes it necessary to cross over through attic space, the piping should be pitched not less than 45°."

So says the *Heating, Ventilating, Air Conditioning Guide* for 1949.* Such attic

*Ibid., p. 413.

crossovers should be insulated to prevent condensation of flue products therein. This also applies to underfloor portions of the venting installation from the appliance draft diverter to the vertical flue, when such portions exceed 5 ft in length or the equivalent in elbows.

Exterior wind pressures often present unique problems in individual installations, but in general we can expect satisfactory performance when the vertical flue terminates at a point 2 ft above any portion of the structure within 15 ft of the flue and the joints of the lining are tight. "Because of the small size and low temperature, Type B vents should be provided with a vent cap with wire screening to prevent building of birds' nests."* This cap should be of a design which has been laboratory approved for the use, and not any gadget dreamed up in a tin shop which may unduly restrict the flow of the flue products to the outside atmosphere. The wire screening should be ½-in. mesh hardware cloth and should be in the form of a cone or pyramid placed over the terminus of the flue so all parts will be warmed sufficiently to prevent condensation and freezing in severe weather, which would ultimately result in a flue blocked with ice.

Frictional resistances may result from undue roughness of material, but the worst cases result from careless usage of elbows, especially in the vent pipe, running from the draft diverter to the vertical flue. The use of 90° lateral elbows should be absolutely prohibited and no venting installation should start with a lateral elbow connection at the draft diverter. If at all possible, not more than two 45° lateral elbows should be used, and a minimum continuous pitch of not less than ½ in. per running foot must be maintained in all parts of the lateral portion of the vent, including elbows. Offsets in the vertical portion should be avoided except for crossovers, in which case offset from the vertical should not exceed 45°; lateral elbows in this offset are prohibted.

Negative interior pressures are becoming general with the improvements in construction which in many cases result in a negative pressure area being created by the use of such common installations as a wood-burning fireplace or kitchen exhaust fan. This can result in the reversal of the action of the flues serving the heating equipment and since the products of complete gas combustion are obnoxious to none of the physical senses, such a condition can be present to a degree that much property damage can result before detection.

Purdue research in home humidity control brings out that on a normal wash day "as much as 55 lbs of water vapor are generated when both the washing and drying of the clothes is done indoors. On average days, as much as 25 lbs of water vapor are liberated within the house. The sources of this moisture are mopping floors, washing and drying clothes, cooking, shower and tub bathing, washing dishes, human contribution, gas refrigeration, house plants, etc."

After investigations are made of the various sources of moisture, the data obtained are used to make calculations on the relative importance of the sources in contributing to moisture condensation within the home.

As the kitchen is for the most part the work center of the home, one can readily appreciate that the majority of moisture-liberating operations occur here. It follows, therefore, that the kitchen is the logical place for the location of a mechanical ventilating system, and it is shown that air withdrawal rates of from 150 to 300 cu ft per minute are sufficient to provide effective moisture removal when the ventilating system is placed in the immediate vicinity of the range.

Fresh-Air Intake

Consideration of the air movement within a home, conducted on another research project, indicates the advisability of providing a fresh air intake, especially in the small, tightly constructed home.

This project, "Research in Home Humidity Control" is being conducted at Purdue University under sponsorship of the AGA's committee on domestic gas research.*

It will be readily observed that any draft diverters which are exposed to air withdrawal rates of 9000 to 18,000 cu ft per hour will have their action reversed to the point of total spillage of combustion products of the appliances which they serve. Doors to utility rooms which enclose heating and water heating equipment must be tight and kept closed. No grilled openings should be permitted in the partitions and air for combustion and venting of the products of combustion must be supplied either from the outside or from spaces directly ventilated from outside.

And so it becomes obvious that even when all known rules as to material, fittings, pitch of installation, height above surrounding structures, length of exposure to outside temperatures, flue caps and screens are all complied with, the installation is worthless without the one ingredient which costs nothing. Air is still free and the supply is unlimited. Insufficient air supply is one of the major causes of venting failure and we must always guard against installation of draft diverters in possible negative pressure areas.

Following is a list of 10 simple, practical rules to be observed in all venting installations:

(1) See that a continuous unobstructed supply of air is available at the appliance in sufficient volume for combustion and venting the products of combustion.

(2) Use flues enclosed in masonry chimneys only when no entire side of the chimney is exposed to the weather or an unheated area and the following requirements are complied with: (a) Linings have no offsets. (b) Chimney extends from grade to a point 2 ft above any obstacle within 15 ft of the chimney. (c) Cleanout is below vent connection.

(3) Each flue shall be used for venting appliances from only one floor level.

(4) All flues for venting gas appliances shall have hardware cloth guards to prevent birds nesting therein.

(5) Type "B" flues shall be insulated when passing through attic spaces and shall not be exposed to the weather for a length greater than 3 ft. Attic offsets must maintain steepest possible pitch—never less than 45° from horizontal.

(6) Lateral vent pipes over 5 ft long or installed in unheated spaces shall be insulated.

(7) Connect vents to flues by means of thimbles or fittings designed for this purpose.

(8) Maintain a continuous rise in lateral vent pipes of at least ½ in. per lineal foot.

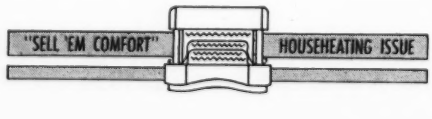
(9) Use no flue smaller than 4-in. diameter or equivalent cross sectional area for venting water heaters.

(10) Maintain equivalent cross sectional area of the draft diverter opening from that point to the termination of the flue.

Observance of these 10 rules will eliminate most of your venting problems. Whenever you are called upon to design, install, or correct the venting of a gas appliance, remember that the first requirement is *air* and plenty of it. From then on test each item to see if there is any other means available which will better expedite the passage of the products of combustion to the outside atmosphere. Do this constantly and you will have little trouble with venting. The law of pressures will work for you if you will permit it to do so.

We hope that in this brief survey we have shown conclusively that the science of venting is not in the dark ages, but is keeping step with the advances in construction and appliance design. We do need better dissemination of laboratory findings and field experiences but this, too, is being taken care of by the multitude of short courses covering the installation and use of gas appliances which are being held all over the country. At long last the importance of these phases is being recognized and the serviceman is coming into his own.

*Engineering bulletin, Purdue University, *Research in Home Humidity Control*. Research series No. 106. The Engineering Experiment Station, Purdue University.



GAS vs OIL vs COAL

a table of comparative heating costs

IN these days of shifting conditions and concepts in the "battle of the fuels" for the househeating load, the comparative costs of the various fuels have taken on new significance. There was a time when the lines were quite sharply drawn: in many areas of the U. S. there was little opportunity for making a choice, as less than a full quota of fuels was available; in many other areas a choice existed, but the high cost of gas heating automatically removed it from the mass market.

These conditions, of course, are being drastically altered. Heavily watered coal prices and the movement of unregulated fuel oil prices are erasing much of the differential, and this fact, coupled with the continued expansion of long-distance natural gas transmission lines, is bringing competition into the picture as never before.

So now, even where there is a price differential unfavorable to gas, it is in many instances so negligible as to be more than balanced by the many advantages of the fuel.

Under such circumstances, an authentic table of cost comparisons might prove to be a valuable sales tool. If figures supplied by a disinterested agency indicate that the price of gas is in close approximation to those of competing fuels, such figures should be brought to the attention of the prospective buyer, his builder, and the architect.

Such figures are now available, having been compiled in extensive tests conducted by the University of Illinois Engineering Experiment Station. The tables, instructions, and examples published on this and the following two pages are reprinted by permission of the university's Small Homes Council from its Circular G3.5.*

The table was derived by converting all commercial quotations for the various classes of fuels to a cents-per-therm basis. Figures given on a single horizontal line are all equal when converted to therms, so market prices for, say, gas and oil appearing on the same line are identical when stated in cents per therm.

In arriving at the figures for gas, the council merely transcribed the standard prices, as gas rates are in many cases expressed in therms (100,000 Btu). For oil, expressed commercially in cents per gallon, the conversion was made by multiplying the market price by 100,000 and dividing the product by the heating value in Btu per gallon. For coal, expressed in dollars per ton, the price was multiplied by 100 to convert it to cents per ton, divided by 2000 to obtain cents per pound, and multiplied by 100,000 with the product being divided by the Btu-per-pound rating.

Further calculation was necessary, however, in order to make the table realistic. Heating plant efficiencies had to be taken into account. The "overall house efficiencies" referred to in the table's footnote were given the assumed values as follows: gas, 80%; oil, heating units designed for oil burning, 80%; oil, heating unit converted to oil, 70%; coal as classified in Column C, 55%; coal and coke as classified in Column D, 65%; and coal and coke in Column E, 80%.

These efficiencies were based on the best judgment of engineers who had analyzed a wealth of data taken in two research residences on the campus. Overall house efficiency, according to the university, is always higher than the efficiency as determined in a laboratory test, because much of the vagrant heat counted as lost in a laboratory test eventually is useful in an actual home installation.

An example of how the table can be proved follows:

The first cost-per-therm figure for gas is 3 cents; for 10,000-Btu bituminous coal, hand-fired without controls, 4.10. Reduced to cost per therms, these should be equal. Converting the per-ton price of coal to therms, multiply by 100 and divide by 2000, which gives .205 cents per pound; multiply by 100,000 and divide by 10,000 to get price per therm—2.05 cents. At a 55% heating plant efficiency, actual cost per therm is 3.7 cents. With gas at 3 cents per therm, 80% efficiency, its cost is also 3.7 cents.

Thus, at the 3-cent price, gas costs the same for fuel as $4.10-per-ton bituminous coal burned in a hand-fired furnace without controls.

*Other circulars in this series on home building are available for 10 cents. For a list of publications, write to the Small Homes Council, Mumford House, University of Illinois, Urbana, Ill.

Table on next page

A GAS	B OIL		C BITUMINOUS COAL (HAND-FIRED WITHOUT CONTROLS) (See note below[2]) (55% efficiency)								
100,000 Btu per therm (80% efficiency)	140,000 Btu per gallon		Heating Value in Btu per pound								
	Heating Unit DESIGNED FOR Oil Burning (80% efficiency)	Heating Unit CONVERTED TO Oil Burning (70% efficiency)	Low			Medium			High		
COST (cents per therm) (See note below[1])	COST (cents per gallon)		10,000	10,500	11,000	11,500	12,000	12,500	13,000	13,500	14,000
			COST (dollars per ton)								
3.0	4.2	3.7	4.10	4.35	4.55	4.75	4.95	5.15	5.35	5.55	5.75
3.5	4.9	4.3	4.80	5.08	5.30	5.52	5.78	6.02	6.25	6.50	6.72
4.0	5.6	4.9	5.50	5.80	6.05	6.30	6.60	6.90	7.15	7.45	7.70
4.5	6.3	5.5	6.20	6.50	6.80	7.10	7.42	7.75	8.05	8.37	8.65
5.0	7.0	6.1	6.90	7.20	7.55	7.90	8.25	8.60	8.95	9.30	9.60
5.5	7.7	6.7	7.57	7.92	8.30	8.70	9.07	9.45	9.85	10.22	10.57
6.0	8.4	7.3	8.25	8.65	9.05	9.50	9.90	10.30	10.75	11.15	11.55
6.5	9.1	7.9	8.95	9.37	9.82	10.27	10.72	11.17	11.62	12.07	12.50
7.0	9.8	8.6	9.65	10.10	10.60	11.05	11.55	12.05	12.50	13.00	13.45
7.5	10.5	9.2	10.32	10.82	11.35	11.85	12.37	12.90	13.40	13.92	14.42
8.0	11.2	9.8	11.00	11.55	12.10	12.65	13.20	13.75	14.30	14.85	15.40
8.5	11.9	10.4	11.70	12.27	12.85	13.42	14.02	14.62	15.20	15.79	16.35
9.0	12.6	11.0	12.40	13.00	13.60	14.20	14.84	15.50	16.10	16.74	17.30
9.5	13.3	11.6	13.10	13.70	14.35	15.00	15.67	16.35	17.00	17.67	18 25
10.0	14.0	12.2	13.80	14.40	15.10	15.80	16.50	17.20	17.90	18.60	19.20
10.5	14.7	12.8	14.47	15.12	15.85	16.60	17.32	18.05	18.80	19.52	20.17
11.0	15.4	13.4	15.14	15.84	16.60	17.40	18.14	18.90	19.70	20.44	21.14
11.5	16.1	14.0	15.82	16.57	17.35	18.20	18.97	19.75	20.60	21.37	22.12
12.0	16.8	14.6	16.50	17.30	18.10	19.00	19.80	20.60	21.50	22.30	23.10
12.5	17.5	15.2	17.20	18.02	18.87	19.77	20.62	21.47	22.37	23.22	24.05
13.0	18.2	15.8	17.90	18.74	19.64	20.54	21.44	22.34	23.24	24.14	25.00
13.5	18.9	16.4	18.60	19.47	20.42	21.32	22.27	23.22	24.12	25.07	25.95
14.0	19.6	17.0	19.30	20.20	21.20	22.10	23.10	24.10	25.00	26.00	26.90
14.5	20.3	17.6	19.97	20.91	21.95	22.90	23.92	24.95	25.90	26.92	27.87
15.0	21.0	18.2	20.64	21.62	22.70	23.70	24.74	25.80	26.80	27.84	28.84
15.5	21.7	18.8	21.32	22.36	23.45	24.50	25.57	26.65	27.70	28.77	29.82
16.0	22.4	19.4	22.00	23.10	24.20	25.30	26.40	27.50	28.60	29.70	30.80

[1]NOTE: To find your local gas cost in cents per therm, divide local market price in cents per 1000 cu ft (your local company can give you the figure that applies in your case) by the number of therms in 1000 cu ft (see below).

TYPE OF GAS	Manufactured			Mixed		Natural	
Average Btu per cu ft	500	600	700	800	900	1000	1100
Number of therms in 1000 cu ft.	5.0	6.0	7.0	8.0	9.0	10.0	11.0

[2]NOTE: Heating value in Btu per pound for a given coal or coke may be obtained from your fuel dealer. All heating values of coal are based on commercial conditions with normal moisture.

*NOTE: Comparisons in the table are based on the assumption that the fuels are burned in the same building and in the same heating system, reasonably well operated and properly adapted to the fuel in use. The costs shown for each type of fuel are based upon average values of the "over-all house efficiency," as determined at the University of Illinois from extensive tests conducted in two research homes where the heaters were located in the basement. "Over-all house efficiency" represents that portion of heat in the fuel which is actually used for heating the *entire house*. Such an efficiency may be affected by differences in house construction, living habits, heating plant design, by installation and by operating controls.

USE OF CHART

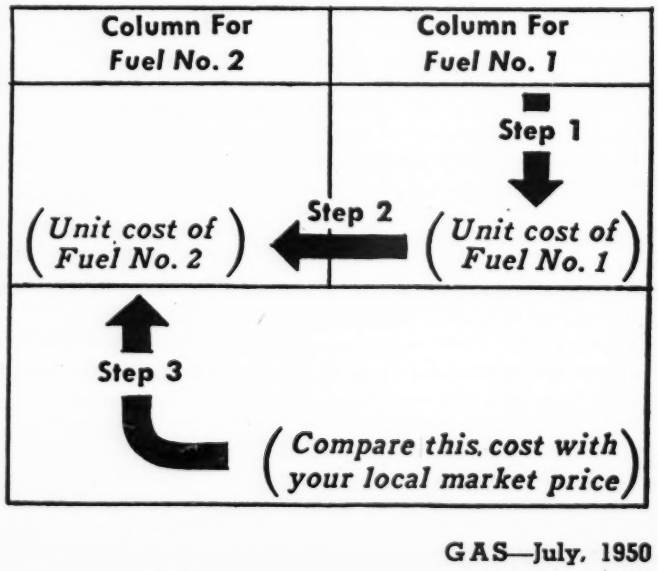
To compare the cost of fuel selected as a base (Fuel No. 1) with another fuel (Fuel No. 2)

Step 1. Locate in the proper vertical column the unit cost prevailing in your locality for Fuel No. 1. (For gas see Section A; for oil see Section B; for solid fuels see Sections C, D, and E. Note that several firing methods and several heating values are shown for solid fuels.)

Step. 2. Read across the table in the same horizontal line to locate in the proper column the comparative unit cost of Fuel No. 2.

Step 3a. If the market price prevailing in your locality for Fuel No. 2 is greater than the cost indicated in *Step 2*, a change to this fuel will increase your total fuel bill.

Step 3b. If the market price prevailing in your locality for Fuel No. 2 is less than the cost found in *Step 2*, a change will lower your fuel bill.


Column For Fuel No. 2
Column For Fuel No. 1
Step 1
Step 2
(Unit cost of Fuel No. 2)
(Unit cost of Fuel No. 1)
Step 3
(Compare this cost with your local market price)

VARIOUS FUELS IN THE SAME BUILDING*

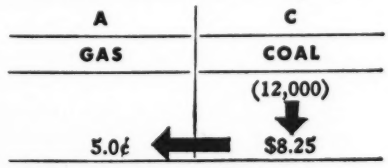
D **BITUMINOUS COAL** (Hand-fired with controls)
BITUMINOUS COAL (Stoker-fired)
ANTHRACITE (Hand-fired without controls)
COKE (Hand-fired without controls)
(65% efficiency)

Heating Value in Btu per pound								
Low			Medium			High		
10,000	10,500	11,000	11,500	12,000	12,500	13,000	13,500	14,000
COST (dollars per ton)								
4.85	5.10	5.35	5.60	5.85	6.10	6.35	6.60	6.80
5.67	5.98	6.25	6.55	6.82	7.10	7.40	7.70	7.95
6.50	6.85	7.15	7.50	7.80	8.10	8.45	8.80	9.10
7.30	7.70	8.05	8.42	8.78	9.12	9.50	9.87	10.22
8.10	8.55	8.95	9.35	9.75	10.15	10.55	10.95	11.35
8.92	9.40	9.85	10.27	10.72	11.17	11.62	12.05	12.50
9.75	10.25	10.75	11.20	11.70	12.20	12.70	13.15	13.65
10.57	11.10	11.62	12.15	12.67	13.20	13.75	14.25	14.77
11.40	11.95	12.50	13.10	13.65	14.20	14.80	15.35	15.90
12.20	12.80	13.40	14.02	14.62	15.22	15.85	16.45	17.05
13.00	13.65	14.30	14.95	15.60	16.25	16.90	17.55	18.20
13.80	14.52	15.20	15.89	16.58	17.24	17.95	18.64	19.32
14.60	15.40	16.10	16.84	17.56	18.24	19.00	19.74	20.44
15.40	16.25	17.00	17.77	18.53	19.27	20.05	20.82	21.57
16.20	17.10	17.90	18.70	19.50	20.30	21.10	21.90	22.70
17.02	17.95	18.80	19.62	20.47	21.32	22.17	23.00	23.85
17.84	18.80	19.70	20.54	21.44	22.34	23.24	24.10	25.00
18.67	19.65	20.60	21.47	22.42	23.37	24.32	25.20	26.15
19.50	20.50	21.50	22.40	23.40	24.40	25.40	26.30	27.30
20.32	21.35	22.37	23.35	24.37	25.40	26.45	27.40	28.42
21.14	22.20	23.24	24.30	25.34	26.40	27.50	28.50	29.54
21.97	23.05	24.12	25.25	26.32	27.40	28.55	29.60	30.67
22.80	23.90	25.00	26.20	27.30	28.40	29.60	30.70	31.80
23.60	24.75	25.90	27.12	28.27	29.42	30.65	31.80	32.95
24.40	25.60	26.80	28.04	29.24	30.44	31.70	32.90	34.10
25.20	26.45	27.70	28.97	30.22	31.47	32.75	34.00	35.25
26.00	27.30	28.60	29.90	31.20	32.50	33.80	35.10	36.40

E **ANTHRACITE** (Hand-fired with controls)
ANTHRACITE (Stoker-fired)
COKE (Hand-fired with controls)
(80% efficiency)

Heating Value in Btu per pound				
Medium		High		
12,000	12,500	13,000	13,500	14,000
COST (dollars per ton)				
7.20	7.50	7.80	8.10	8.40
8.40	8.75	9.10	9.45	9.80
9.60	10.00	10.40	10.80	11.20
10.80	11.25	11.70	12.15	12.60
12.00	12.50	13.00	13.50	14.00
13.20	13.75	14.30	14.85	15.40
14.40	15.00	15.60	16.20	16.80
15.60	16.25	16.90	17.55	18.20
16.80	17.50	18.20	18.90	19.60
18.00	18.75	19.50	20.25	21.00
19.20	20.00	20.80	21.60	22.40
20.40	21.25	22.10	22.95	23.80
21.60	22.50	23.40	24.30	25.20
22.80	23.75	24.70	25.65	26.60
24.00	25.00	26.00	27.00	28.00
25.20	26.25	27.30	28.35	29.40
26.40	27.50	28.60	29.70	30.80
27.60	28.75	29.90	31.05	32.20
28.80	30.00	31.20	32.40	33.60
30.00	31.25	32.50	33.75	35.00
31.20	32.50	33.80	35.10	36.40
32.40	33.75	35.10	36.45	37.80
33.60	35.00	36.40	37.80	39.20
34.80	36.25	37.70	39.15	40.60
36.00	37.50	39.00	40.50	42.00
37.20	38.75	40.30	41.85	43.40
38.40	40.00	41.60	43.20	44.80

EXAMPLES:



Market price of coal —$8.25 per ton
Comparative cost of gas—5.0¢ per therm
Market price of gas —6.0¢ per therm
*Bill for gas = $66.00 × 6.0/5.0 or $79.20

Comparing Two Fuels . . .

• Each winter our house uses 8 tons of 12,000 Btu *bituminous coal*, costing $8.25 per ton, or $66 per season. Our furnace is hand-fired, and has no controls. About how much would my fuel bill be if I used *gas* which costs 6 cents per therm in my locality?

1. Locate your local market price for coal ($8.25) in proper vertical column under C (12,000 hand-fired bituminous without controls). This is Fuel No. 1.
2. On the same horizontal line find the comparable cost for *gas* (5 cents) in vertical column under A. This is Fuel No. 2.
3. The market price prevailing in your locality for *gas* (6 cents) is greater than the price indicated in *Step 2* (5 cents). A change to this fuel would increase your total fuel bill.

Comparing Three Fuels . . .

• I am selecting a heating unit for my new house. The cost of *oil* is 10.5 cents per gallon, the cost of *gas* is 6 cents per therm, and the cost of a good grade of *bituminous stoker coal*, with a heating value of 12,000 Btu per ton, is $10.25. What would be the comparison between total fuel bills?

Market price of oil —10.5¢ per gallon
Comparative cost of gas— 7.5¢ per therm
Market price of gas — 6.0¢ per therm
*Bill for gas = 6.0/7.5 or 0.8 times bill for oil
Comparative cost of coal—$14.62 per ton
Market price of coal —$10.25 per ton
*Bill for coal = 10.25/14.62 or 0.7 times oil bill

1. Select oil (column B, "Heating Unit Designed for Oil Burning") for a base. Move down column to unit cost of 10.5 cents per gallon.
2. Read across to column A (gas) and D (stoker-fired bituminous coal @ 12,000 Btu.). You will find comparative unit costs to be: Gas — 7.5 cents per therm; stoker coal — $14.62 per ton.

3a. Your market price for gas (6 cents) is less than listed unit cost (7.5 cents). In this case, the fuel bill for gas will be less than for oil.

3b. Your market price for stoker coal ($10.25) is less than listed unit cost of $14.62. In this case, use of stoker coal will decrease the fuel bill with respect to oil.

Supplementary Costs . . .

• To obtain the cost of operation when using stokers or oil burners (other than the pot type), it is necessary to add the cost of the power for operating the motors to the cost of the fuel used. The average power consumption of oil burners and stokers is:

Oil Burners—0.1 kilowatt hour per gallon of oil fired.

Stokers—10.0 kilowatt hours per ton of coal burned.

• To obtain the electrical power cost, multiply these values by the local electrical rate (cents per kilowatt hour).

Variations resulting from differences in operating conditions make it impossible to give definite figures for either depreciation, maintenance or repairs. These costs, however, should be considered in addition to the initial costs of your heating system and fuel.

NEW IDEAS IN HOUSEHEATING

1. Principles and Advantages Of 'Safety-Sealed' Heat

By R. C. OVERMYER
Stewart-Warner Corp., Indianapolis

STEWART-WARNER Corp., through its experience with "sealed" combustion heaters for the automotive and aircraft industries, has been instrumental among manufacturers of gas heating equipment in developing a flexible line of heating units that are *inherently* safe. Burning gas in a sealed chamber, they draw air for combustion from outdoors through a sealed vent and discharge all products of combustion to the outdoors through another sealed vent.

Exclusive

Since venting should be considered as much a part of the installation of gas heating equipment as the equipment itself, the cross section of the "Saf-Aire" Model 992-20 *(Fig. 1)* illustrates how these two problems are integrated in "safety-sealed" equipment. Chances for error in installation are either eliminated completely or greatly minimized.

As a result, many advantages long sought by independent researchers in the gas industry now can be found by home owner, dealer, contractor and the industry alike in this type of installation. To the industry this development made possible the use of properly sized, efficient equipment that would distribute the heating load and help reduce any heavy peak requirements that might be caused by more wasteful installations.

For home owners the idea of efficient, completely vented, room-size and multiple-room units meant new convenience and comfort. Room-by-room control of temperature and a steady, even flow of heat that kept floors warm and corners comfortable was the natural result of having many heating units, each with its own cold air return. The right amount of heat for "in-between" seasons no longer was a problem. The fact that all installations were in the wall and needed no flue or chimney saved floor space and permitted location of the units for most effective circulation.

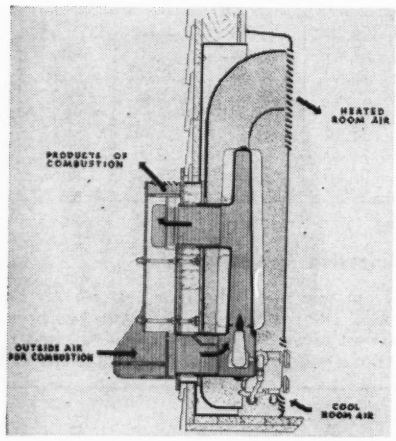


Fig. 1. Cross-section of South Wind's "Saf-Aire" model 992-20.

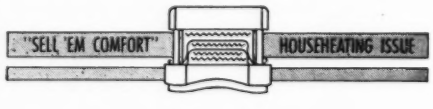
In addition to these natural advantages, the sealing of combustion chamber and vents made it *impossible* for products of combustion to escape into the house. Likewise no warm room air could be used for combustion or be sucked up the flue through a draft diverter. Finally, here was heating equipment that was absolutely clean.

Anyone experienced in making heating layouts recognizes the advantages of zone control and realizes the usual high cost of this luxury type of comfort—now readily available at reasonable cost with safety-sealed units. Architect-designed homes for comfortable living no longer cause headaches for the heating contractor. Completely capable of heating any home economically, these versatile units also can be adapted in conjunction with a central type system to "zone off" areas with fluctuating heat requirements. Any hard-to-heat room readily is made comfortable by the installation of a room-size unit.

Installation itself is neither difficult nor time-consuming. These units can be mounted without cutting studs in the wall—an easy job for any experienced worker. In Saf-Aire models only a gas line connection is required. No electricity is necessary. Builders find that they can reduce time on the job for a heating installation and save on expensive labor and material charges.

Because no warm air is used for combustion and venting, the design of Stewart-Warner equipment provides up to 20% greater efficiency compared with conventionally designed equipment of equal input ratings. The consequent savings in fuel and the added comfort and convenience of automatic sealed-combustion heat means a good bonus to owners over a short period of years.

Negative pressures inside the house caused by kitchen and attic exhaust fans do not affect the operation of these units. High winds and all types of weather make no difference in their efficiency. The fact that combustion chamber and vents are sealed eliminates any condensation of vapor products inside the room. There are no exposed flames, no



A group of four exclusive articles which describe new heating developments that appear to be strong contenders in the rapidly expanding heating market.

He's on your staff but not your payroll

It was a tough heating problem. Some dealers even ducked it. But the Bryant dealer called on a proved source of engineering aid. And the Bryant distributor brought in the answer that landed the contract.

Yes, Bryant distributors welcome such opportunities. Complete and thorough factory engineering assistance is at their call. Thus, thinking of the industry's largest staff of gas heating engineers becomes a plus value for Bryant dealers.

Other plus factors of the Bryant program are the opportunity of getting most everything in gas heating equipment from a single source . . . a near-by distributor with adequate warehouse stock . . . advertising co-operation that helps pay the cost of dealer localized campaigns and backs them up with powerful national advertising.

Utilities benefit from this Bryant dealer program, too. It means *better equipment* on your mains . . . *better sold* and *better installed.*

Let the pup be furnace man
. . . and water boy, too!

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( ) Send me the new booklet that tells the Bryant story. ( ) Have your distributor call on me.

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Company_____

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Fig. 2. (Above). South Wind's finned heat exchanger with sealed vents to outside.

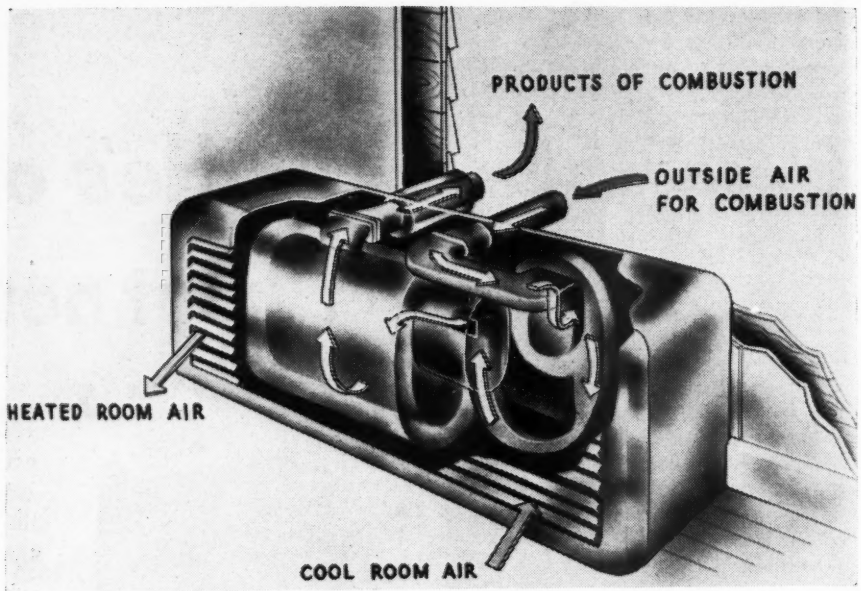


Fig. 3. (Right). Cross-section of zone-heating unit.

dangerously hot surfaces. Operation of all units is extremely quiet.

All safety-sealed models are self-contained, independent heating systems. They are compact and lightweight, with room panels styled to harmonize with any interior. Saf-Aire models are partially recessed gravity convectors made for installation in any outside wall between the stud space. The room panel extends less than four inches into the room. Principal elements in the design are the Lundstrum vent on the exterior wall, the sealed combustion chamber and finned heat exchanger *(Fig. 2)* with sealed vents to the outside, the burner and "Unitrol" burner controls with floor line thermostat, the insulated rough-in box and heat baffle, and the room panel. Rated inputs of the two models are 14,000 and 20,000 Btu/hr.

All South Wind models are forced-air zone-heating units (see *Fig. 3)*. In addition to being thermostatically controlled, all room models feature full modulation that automatically maintains a constant balance between the flow of heat and the heat loss of the rooms. Rated input is 31,000 Btu/hr. South Wind units are complete with sealed vent accessories for mounting on either an inside or outside wall or in the dividing wall between two rooms. On a thermostatically controlled zone furnace for underfloor, attic or closet installations, the input is 35,000 Btu/hr.

Cabinet interiors are thermally insulated. Removable front grilles are equipped with sound-absorbing louvers. Other components include a stainless steel heat exchanger, drilled-port burner, modulating fuel governor, automatic spark ignition (shielded to prevent radio interference), flame detector switch, safety lock-out switch, 100% safety shut-off, main fuel shut-off valve and "squirrel-cage" type ventilating air blower.

Primary markets to be served by this type of heating equipment, of course, include homes in the South and Southwest, where small unit heating is an accepted method. Motels, resorts needing flexible, small heating units; schools, hospitals, and commercial establishments are sales targets and by no means should home heating in other parts of the country be less attractive as a market.

2. The Air-Wall Eliminates Cold Window, Wall Discomfort

By C. M. TOELAER

General Electric Co., Air Conditioning Dept.
Bloomfield, N. J.

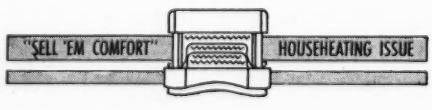
AIR-WALL is one of the most recent developments in warm air heating. It represents an important advancement in the forced circulation field.

Exclusive

As a result of several years of research in the laboratories of the General Electric Co. and numerous field trial installations, the general pattern for Air-Wall was developed.

In nearly every form of radiation heating (steam or hot water radiators), the heat is introduced to the room at or near the outside wall, minimizing the discomfort which cold windows and walls inherently cause. With conventional warm air heating this is not common practice, and home owners frequently find it necessary to maintain room-air temperatures 3° to 5° higher with extreme outdoor temperatures. Air-Wall provides this comfort advantage of wet systems in a warm air heating system. The air is directed in such a manner as to oppose the normal drafts in the room. The register is designed to distribute the air in a fan-like pattern up the outside wall *(Fig. 1)*.

Air-Wall is not a high-pressure nor is it a high-velocity warm air distribution system. The system is based on maintaining a pressurized plenum with 185° to 200°F air, distributing the air through 4-in. round ducts to special supply outlets located on the outside wall — under the windows, where possible. The air is distributed in a fan-like pattern up the outside wall to provide a mild radiant effect and to over-



come the cold drafts tumbling off the windows. Air-Wall was designed around the General Electric warm air furnaces, their fan characteristics, and their internal pressure drop.

The use of air at higher temperature than is common practice in the industry with conventional warm-air heating systems requires a lesser volume to be moved. This, along with the somewhat higher velocity, naturally results in smaller duct work, which in turn gives a lesser outside duct area, reducing the duct heat loss.

Extensive tests indicated that aspirating room air at the face of the register was superior to the use of internal mixing. A grille was developed that caused room air to be mixed with furnace air external to the register. The Air-Wall register is the heart of the system.

Studies were made using ducts of various diameters from 2½ to 6 in. Four-inch ducts, which could be easily ovaled to fit in a 4-in. stud space, were deemed the most practical, as a minimum number of supplies was needed. The requirements established by the National Board of Fire Underwriters for a low temperature system apply. The use of 4-in. ducts also made it possible to use standard, readily available duct work.

The system has the acceptance of the FHA for use in properties otherwise eligible for mortgage insurance under the minimum property requirements and risk rating procedure of the administration.

Air-Wall combines all of the advantages of forced circulation warm air heating with many of the advantages of panel heating, baseboard radiation, hot water heating, and nearly every other popular form of heating in use today.

Some of the advantages of the system are:

1. Overcomes the heat loss where it occurs because of the outside wall register location.
2. Provides mild radiant heat as well as convected heat.
3. Overcomes cold drafts; eliminates cold floors.
4. Provides quick response to temperature changes because of the low quantity of cold air stored in the ducts when the fan is off.
5. May be balanced from one central location after installation.
6. Is easily designed, easily installed.
7. Provides filtered, humidified, circulating air.
8. Provides convenient register shut-off with no air whistle.
9. Minimizes over-shooting.
10. Eliminates initial cold blast of air.
11. Features attractive wall grilles.
12. Does not blow air across the room.
13. Requires no stocking of non-standard parts.
14. Is low in cost.

Fig. 1. A typical Air-Wall outlet location, in San Francisco's West Lake development.

With Air-Wall the location of the returns is of little importance — they are only required to bring the air back to the furnace and the reduced air flow with this system makes it possible to bring the return air back at most any location without causing drafts in the rooms. Seven-inch round ducts are normally used for returns, although rectangular duct work is quite frequently used.

Air-Wall was originally introduced for the small home in order to reduce installation costs and at the same time provide a high comfort level in the home. The system proved so popular

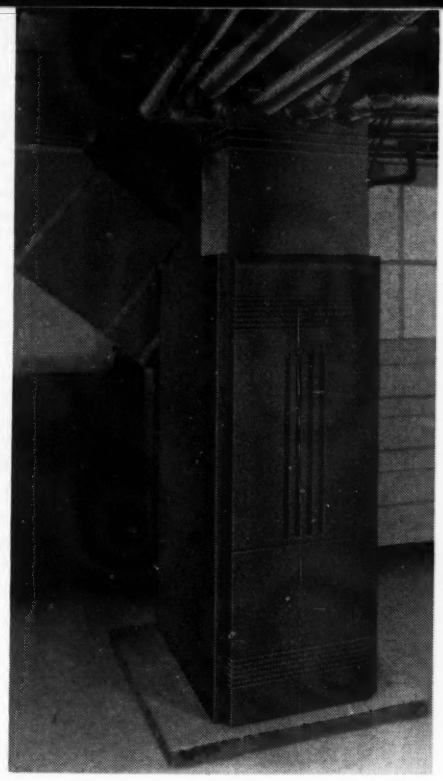


Fig. 2. Air-Wall furnace and duct work in a typical installation.

that it has been constantly necessary to extend the applications to larger structures. Today General Electric heating distributors are well qualified to design systems using either separate run-outs or extended plenums, employing extended plenums for the ranch type home or in homes where the furnace is located at one side of the building.

The necessary design data for 5-in. duct systems is also available for applications in remote rooms where one supply will provide adequate distribution. One or two 5-in. ducts on the smaller size furnaces in no way affect the performance of the system.

Air-Wall is less expensive to install than a first quality conventional forced warm air system with properly located supply and return outlets. Naturally, however, warm air systems can be installed where no consideration is given to air distribution.

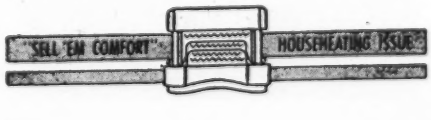
On the smallest General Electric gas-fired warm air furnace as few as six registers may often be used. A new floor-type register was recently introduced (see *G A S*, April 1950, p. 66). The system is now available through the complete range of gas furnace sizes, from 48,000 to 168,000 Btu output.

Many home owners have reported appreciable savings with Air-Wall because of the reduced stratification which results and the more uniform temperatures throughout the room. These along with the reduction in drafts and the mild radiant effect have made it possible to maintain a lower thermostat setting which naturally results in fuel economy.

With most Air-Wall systems, the temperature difference between the floor and the ceiling has been found to be less than 3°. When higher floor temperatures are maintained the average temperature in the occupied level more uniformly approaches the thermostat setting. Furthermore, the lower temperatures at the ceiling reduce appreciably the heat loss through the ceiling.

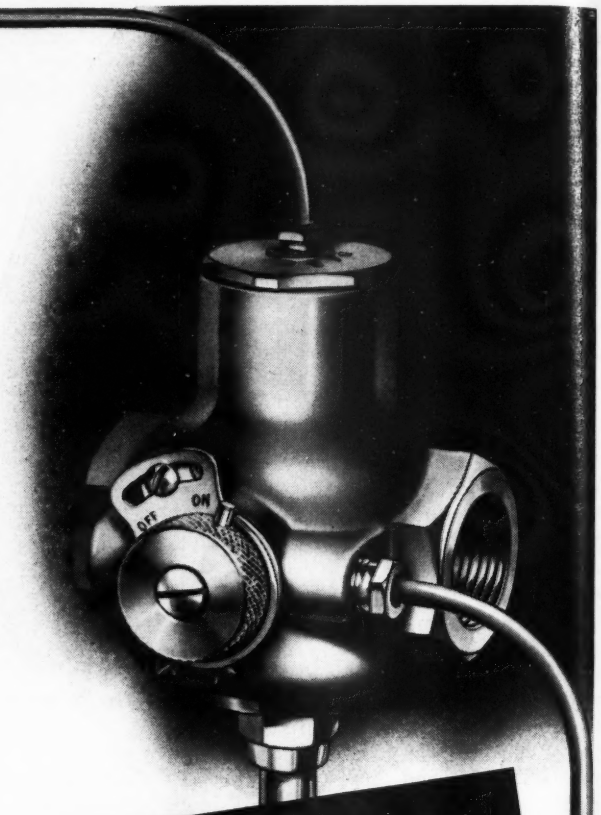
Fig. 1 shows a typical outlet location in one of the larger building projects. This project is one of the largest developments in the western portion of the United States, the 700-unit, $125 million subdivision known as West Lake, a suburb of San Francisco.

Fig. 2 shows the furnace and duct work in the Stewart Homes in Plainfield, N. J., another Air-Wall project located in the metropolitan area of New York City. This figure shows the 4-in. round ducts and the dampers at the plenum, and return ducts which lead to convenient inside wall locations. This is a typical rectangular return duct Air-Wall system.



IGNITION SYSTEMS

DON'T HAPPEN...

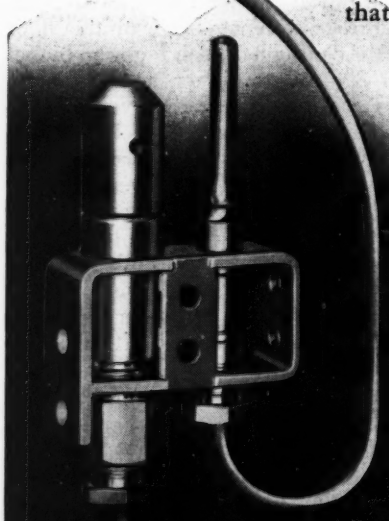


BASO SAFETY PILOT with Annulair PILOT BURNER

Good ignition systems are the direct results of engineering brains applied to the problem of lighting a main burner quickly. Take the A824 Baso and the Annulair pilot burner, for example. You won't find a better valve and pilot burner for that big space heater. They're built of the best materials for the job, in a modern plant, under close inspection.

The valve, with its rotor pilot valve and openings of ⅜", ½", and ¾", and the pilot burner, with many tip styles and orifice inlet fittings for various fuel gases, are twin units of precise manufacturing processes.

With these units, a good ignition system begins; but it is not achieved until Milwaukee Gas Specialty Engineers, working with you, have put that space heater through its paces, rechecking the results, until good ignition is a certainty, false safeties eliminated, and turn-down conditions satisfied. Milwaukee Gas Specialty Company engineers can prove all this to you—that good ignition does not happen.



Annulair Type 2D11

WRITE FOR BULLETIN SC 300-34

KEE GAS SPECIALTY CO.
MILWAUKEE 1, WISCONSIN

3. Forced Air Heating Where Space is Limited

By A. J. HORN

Payne Furnace Division
Monrovia, Calif.

IT is axiomatic that evolution in the design of gas fired heating equipment has always closely followed the existence of an unsatisfied need. Rarely is this relationship so well demonstrated as in the development of the horizontal type forced air furnace which is frequently referred to as an "attic furnace."

Exclusive

Until shortly before World War II, only two types of forced air gas fired furnaces were generally available. One was the conventional type of forced air furnace, primarily adopted for basement installations. The other, still a relatively new type of furnace, was designed in such a way as to facilitate its installation in a closet or utility room. This so-called "closet" furnace was characterized by having the blower mounted below the heating element and was designed to facilitate all servicing from the front side of the unit. Its development was in response to the need for a forced air furnace particularly adaptable to non-basement type residential and apartment house construction.

The installation of a closet-type furnace in new non-basement type construction presented no problem because the architect or builder could provide a suitably located and sized closet or utility room for this purpose. As forced air heating became more popular, it became apparent that the basement and closet type forced air furnaces could not be adapted to a large percentage of the existing non-basement type homes which predominate in the western and southern states. A utility room or closet space was either not available or could not be spared. It was during the late '30's that the horizontal or attic type forced air gas fired furnace made its first appearance as the answer to this need. With construction costs soaring, there was an extra inducement to save floor areas which might be required for a furnace closet.

The general design requirements for a horizontal type forced air furnace can be listed as follows:

1. Minimum height to facilitate its installation in low pitch roof attic spaces. This requirement was responsible for the long, horizontal design of these furnaces.
2. Minimum cross-sectional dimensions of the entire unit or its components in order to facilitate installation of the unit through average or moderate size skuttle openings.
3. A design that would permit performance of all servicing operations from one side. By limiting accessibility to one side, less attic space is required, which frequently becomes an important factor.
4. Quiet operation and effective isolation to prevent transmission of motor or blower vibrations.

Attic Installation

Good installation practice calls for locating attic furnaces over or near load-bearing partitions. Although attic furnaces are generally designed with emphasis on a minimum of vibration, the location of these furnaces over a long ceiling joist span is an invitation to probable complaints.

While not entirely essential, it is also good practice to provide a floor of rough sheathing boards on the ceiling joists under and in front of the furnace. Also, whether or not local building ordinances make it mandatory, the area under the furnace and 6 in. beyond its sides should be protected with ¼-in. asbestos paper or millboard protected by sheet metal. This recommendation is made in spite of the fact that all AGA-approved forced air furnaces are tested to ascertain that no part of the casing, which might come in contact with combustible materials, exceeds 90° above room temperature. Although remote, there is a possibility of a gas valve sticking open or of limit-control failure, in which case the presence of such insulation precludes a possible fire hazard.

Most heating contractors favor the use of round pipe and fittings for attic warm air duct systems, because of the ease with which these prefabricated fittings are joined and insulated. Some installers have been very successful in the use of high side wall or ceiling diffuser-type supply registers and adjustment of the furnace controls for CAC (continuous air circulation), as recommended by the National Warm Air Heating and Air Conditioning Assn. Other heating contractors are inclined to favor the use of low-wall discharge registers, particularly where extensive glass exposures are encountered.

Under-Floor Installation

Another application of the horizontal-type forced-air furnace which is becom-

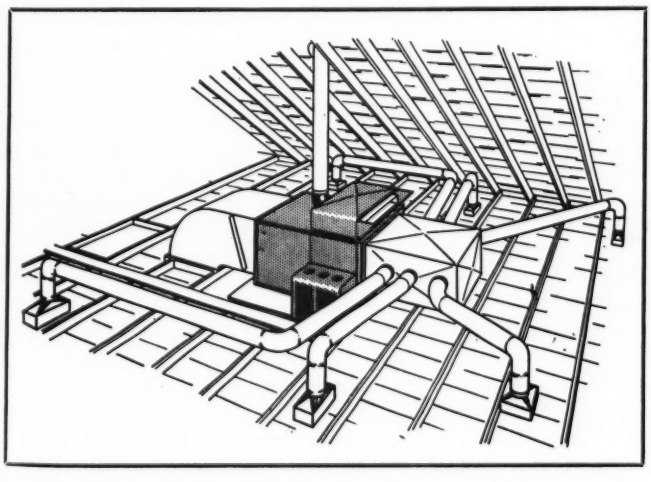


Fig. 1. Attic furnace installation with simple insulated round pipe warm air distribution ducts.

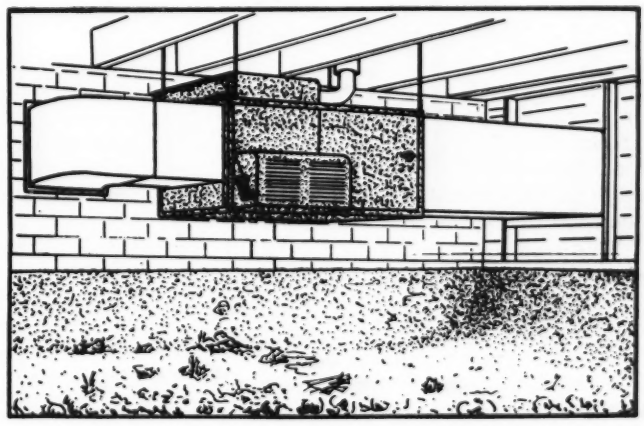


Fig .2. Under-floor type installation with horizontal forced air furnace suspended from floor joists.

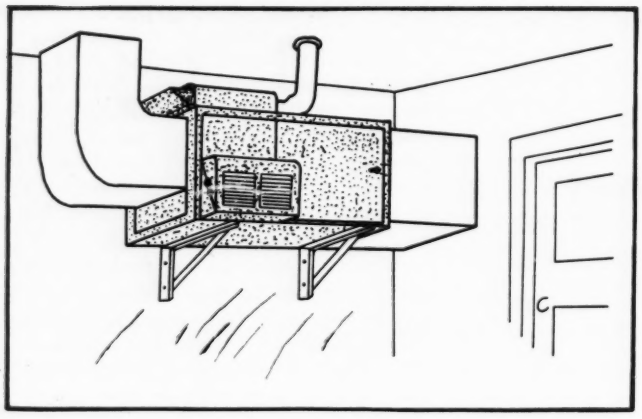


Fig. 3. Utility room or service porch installation saves valuable floor space.

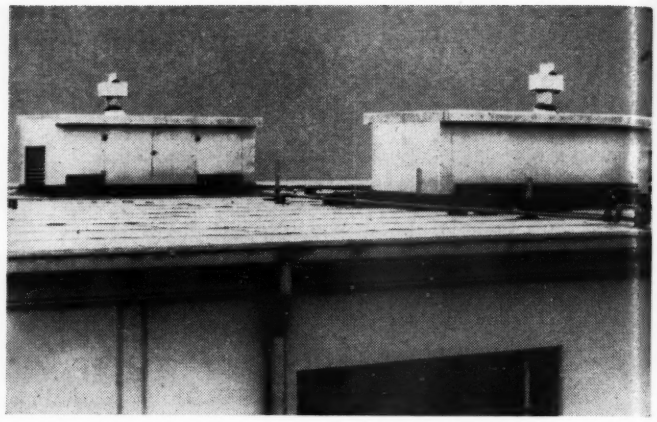


Fig. 4. Typical "penthouse" type horizontal furnace installation on flat roof of commercial building.

ing increasingly popular is the under-floor installation. Its popularity is not limited to flat roof construction which provides no attic for housing this type of furnace. Most proponents of under-floor installations appear to favor this system mostly because their experience indicates that the incidental use of base-board or floor registers is conducive to exceptionally good heating.

This type of installation is, however, not without its own type of limitations. Particularly where the space between the under side of floor joists and the ground is limited, venting becomes a problem from the standpoint of maintaining the desired rise or pitch of the horizontal vent pipe. Failure to maintain the necessary recommended minimum ½-in. rise per foot of horizontal vent pipe may result in excessive flue products spillage from the furnace draft hood relief opening. This, in turn, can result in complaints about excessive humidity because the water vapor from these flue products seeps through the floor up into the house. Consequently, the location of the furnace is more frequently determined by its proximity to the vertical vent pipe than location with respect to the rooms to be heated.

Another important factor to consider on under-floor installations is protection against ground moisture. If the furnace is set on any porous or moisture transmitting materials, such as wood blocks or concrete, a sheet of galvanized steel or aluminum should be placed under the furnace as a barrier to moisture seepage. An alternate method is to suspend the furnace from the floor joists.

The problem of accessibility should also not be neglected on under-floor forced air furnace installations. Where the furnace is not easily or directly accessible from access doors in the outside foundation wall, trap doors of adequate size, located in the hall or a closet, should be provided. Some contractors have found it advantageous to locate the furnace close to a side or rear outside wall. This solves not only the problem of accessibility but also of venting, because the vent can be installed on the outside of the house.

Further examples illustrate the extraordinary versatility of the horizontal type forced air furnace. Where an under-floor installation is not feasible, a small metal or plywood enclosure next to an outside wall solves the problem. Warm air supply or return duct connections are easily made from this location. Installing the vent on the outside wall contributes to a low installation cost and also very satisfactory vent performance because of the direct connection.

Another method for overcoming forced air heating installation space limitations in both new and old homes is that of suspending the furnace from the utility room ceiling. This out-of-the-way method of installation makes it unnecessary for the home owner to sacrifice any of the limited and valuable floor space of his utility room. The warm-air duct system for such installations frequently consists of a shallow extended plenum located in a furred hall ceiling space and discharging through high outlet registers into the adjacent rooms. Where this is not feasible, the conventional attic round pipe duct system is used.

One of the most novel applications of the horizontal-type furnace is its installation in a low penthouse on a flat roof. This type of installation is especially applicable to flat-roof commercial buildings where the inside ceiling height does not permit the use of unit heaters or where a suite of offices or rooms is to be heated. Warm-air heat distribution is accomplished through ducts located in furred spaces in the hall ceiling or alongside a main support beam. Outlet registers may either be the conventional side wall type or ceiling diffusors.

A return air system consisting of one or two centrally located grilles in the ceiling appears to produce satisfactory heating results, provided the outlet or supply grilles are properly located and sized to produce the proper outlet velocity. Properly adjusting the furnace for CAC (continuous air circulation) is also an important factor in securing good heating system performance.

Another important application for the horizontal forced air furnace is its use as a unit heater. Its use is particularly appropriate where a greater degree of quietness—than can be obtained with propellor fan type unit heaters—is required. Such applications include large office spaces, class rooms, auditoriums, etc.

Occasionally heating contractors encounter a unit heater application calling for a 90° downward from horizontal air delivery. A propellor type unit heater is not recommended for this type of application, especially if the heating unit has to be mounted very high off the floor. The use of a centrifugal blower on horizontal type forced air furnaces provides the efficiency and capacity required to discharge the outlet air with sufficient velocity to reach floor level and thereby do a good heating job under these conditions.

It is obvious that the use of gaseous fuels is a large factor in making the extraordinary versatility of the horizontal type forced air furnace possible. The practicability of installing this type of furnace in confined, out-of-the-way spaces and at a low cost are important advantages to utilities and dealers when competing against liquid fuel type furnaces. The saving of floor space can also be a primary consideration.

Because of its extraordinary versatility, the future market for the horizontal type forced air gas furnace is definitely assured. As time goes on, more and more advantageous applications for this type of urnace will be developed. The alert and enterprising gas utility and heating appliance dealer will, therefore, be well advised to become thoroughly familiar with the horizontal type forced air furnace and its potentialities.

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and a Universal makes it
BROIL LIKE CHARCOAL !

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EXTRA *in baking*

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EXTRA *in roasting*

A Universal gas flame gives a *constant* heat while the oven is working. Not on-and-off, but up-and-down. That's why roasts are done steadily. That's why a Universal gas range roast tastes good!

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Charcoal is a combination of flame and glow. Universal's Radiant Mesh Broiler Burner restores the hot bed and puts in charcoal's double punch—flame and glow. It's exclusive.

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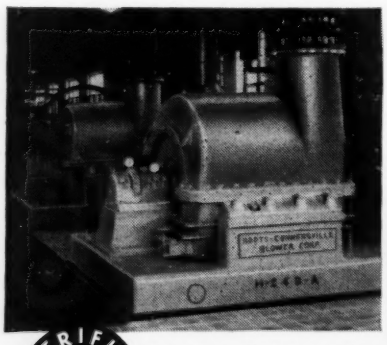

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Two Type H, 4-stage Centrifugal Gas Compressors, capacity 12,500 cfm each, in gas plant service. Driven by steam turbine.

This R-C Rotary Positive Exhauster has been in gas plant operation since 1926. Driven by variable-speed steam engine. Capacity 1,500,000 cfh of coal gas.

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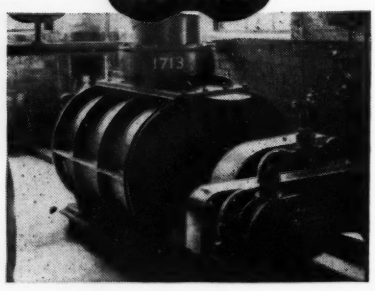

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4. The 'Tallboy' Joins the Field

By VERNON M. VIERTH

Lennox Furnace Co.
Marshalltown, Iowa

SOMETHING new has been added to the field of winter indoor comfort facilities for the small home owner.

Exclusive

It is a series of heating systems known as "Tallboys," designed and built by The Lennox Furnace Co., using the gravity method of warm air circulation, wherein heated air is circulated through a home without the use of fans and blowers.

Lennox engineers designed the Tallboy for the small basementless house.

Heretofore, the only blowerless type of heating available for homes without basements has been the hot-air heater. These new Tallboys circulate more than twice the volume of air moved in any other wall space heater, and comfort is produced with warm air—not hot air.

Tallboys get their name from the fact that in some models they are as much as 7 ft high, yet in outside dimensions range from only 16 in. to 2 ft square in the various sizes. They fit into a small closet or alcove and they can easily be furred into the wall construction of the living space at minimum expense, or they can be tucked away in the corner of a room.

Warm air flows out in waves through overflow grilles attached to the unit. Where desired, ducts or pipes can be added to some of the Tallboys to carry warm air through registers from the furnace.

This method of small house heating was first introduced about two years ago, and today is standard indoor comfort equipment in thousands of small homes in the nation and in an innumerable number of low-cost housing projects. The unit, however, is also applicable to personalized heat for the apartment dweller. This type of installation solves the problem of individual comfort needs, and appeals to the builder and owner through elimination of a service problem which is as old as the apartment house program itself.

In addition to this, certain models of these gravity Tallboys can also be installed neatly and compactly as basement gravity furnaces.

Lennox Tallboy models now available range in size from 35,000 to 70,000 Btu input. They are adapted to all types of gas fuel, including LP-Gas and gas-air.

Now!...You can sell the TWO Hamilton TRADE-MARK REG. U. S. PAT. OFF. Automatic GAS CLOTHES DRYERS

1 Hamilton "Matchless Ignition" Gas Dryer is completely automatic! (No matches required.) Platinum glow coil ignites pilot light. Just set simple timer and it starts! Model No. 1100-G

2 Hamilton Standard Gas Dryer, Model No. 1000-G, has the same superior features as Model No. 1100-G except automatic ignition.

Join the Great Hamilton Dealer Sales Force!

Now you can increase profits with *two* Hamilton Gas Clothes Dryers! Sell the important extra advantage of "matchless ignition" in a new deluxe model Hamilton Gas Dryer. Just set the simple timer and it starts . . . it's *completely automatic*, it's a convenience feature your customers want! Besides this new deluxe model, the Hamilton Gas Dryer line includes the standard model without "matchless ignition."

Market Unlimited! Only one woman in every 200 of your potential customers knows the wonderful Hamilton freedom from washday woe! Here is one product which offers *you* a *clear* profit —no trade-ins, no "used" appliances to be resold, no second-rate "tag-alongs" to buy! 63,000,000 *consumers* are reading the Hamilton story in the great Hamilton "Badge of A Drudge" national advertising campaign!

Sales are piling up **. . . more and more dealers are joining the great Hamilton "Clothespin" promotion and making profits accordingly! See your Hamilton Distributor today!**

In Canada the Hamilton Dryer is known as the Coffield-Hamilton Automatic Clothes Dryer, and is distributed by Coffield Washer Co., Hamilton, Ontario.

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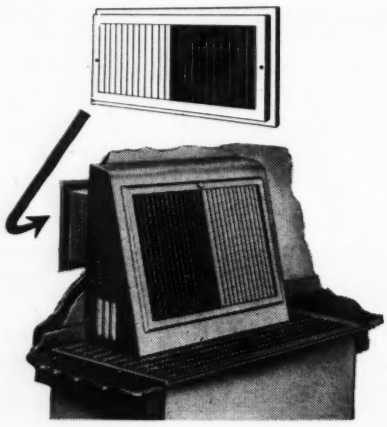
Hamilton TRADE-MARK REG. U. S. PAT. OFF. Automatic GAS CLOTHES DRYER

NEW PRODUCTS

Floor Furnaces



WARD HEATER CO., 1800 W. Washington Blvd., Los Angeles 7.

MODEL: Ward Bathroom Register Furnace.

APPLICATION: For hall-bedroom or bedroom-bathroom installations.

DESCRIPTION: This exclusive design meets a specific need. It offers a two-room combination heater, such as hall-bedroom or bedroom-bathroom, at a minimum cost.

Furnace can be easily installed with a minimum of wall cutting for the single wall register. Louver can be opened or closed from either side so that heat can be directed into only one room or divided between the two areas, as desired. It has the advantage that the cold air return is only from the one side.

The new furnace can be equipped with wall-type thermostat controls.

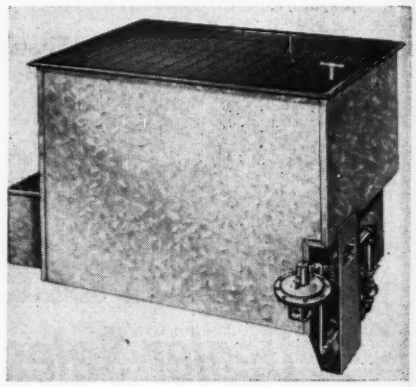
* * *

AMERICAN RADIATOR & STANDARD SANITARY CORP., Pittsburgh, Pa.

MODEL: Navaho.

APPLICATION: Designed for the average small home with or without basement.

DESCRIPTION: This unit is manufactured in three sizes, ranging from 25,000 to 50,000 Btu input per hour. The unit is shallow, requiring only 27½ in. maximum below the floor. The two smaller sizes fit between standard floor joists. All three sizes are 36 in. long, and the largest is 22 in. wide. Supported by flanges on all sides, the top of the



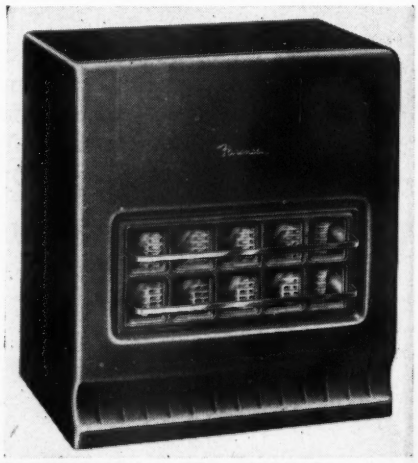
Navaho fits snugly against the floor with all controls concealed.

Each of the sizes is available with a flat floor grille or a dual wall register. Optional equipment includes electrical controls which provide automatic operation.

Space Heaters

FLORENCE STOVE CO., 205 School St., Gardner, Mass.

MODEL: RCV45.



DESCRIPTION: This 45,000-Btu input model is one of seven new heaters recently introduced. This radiant-circulator vented model features Florence's multi-heat burner, automatic controls, draft-diverter construction, and directed floor-level heat.

THE BEST SALESMAN YOUR GAS EQUIPMENT EVER HAD MODEL 54 GASAPACK

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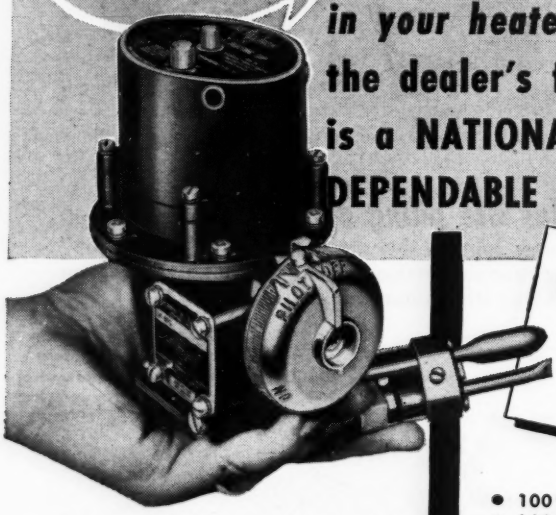
in your heater or furnace on the dealer's floor because it is a NATIONALLY ADVERTISED DEPENDABLE Gas Control



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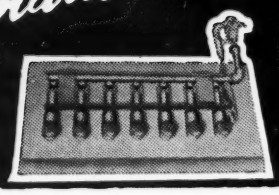
*Floor Opening 30 5/16" x 34 5/16"

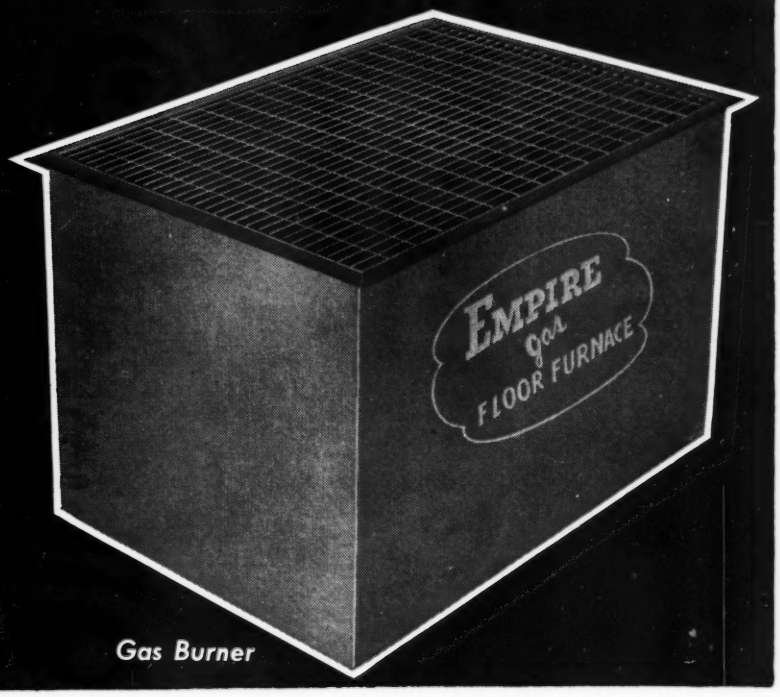
EMPIRE

"Lo-Boy" Floor Furnace

Here's a completely new EMPIRE "Lo-Boy" . . . only 24 inches from top to bottom, requires a minimum of floor space . . . yet gives maximum efficiency with a 70,000 B.T.U. input. Equipped with the famous "Thriftmatic" Burner for greater economy and efficiency of operation with all kinds of gases.

"Thriftmatic"





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Another GREAT, NEW PROFIT-MAKER added to the Famous EMPIRE Line of Gas Appliances

For increased sales . . . greater profits . . . it's the new 70,000 "Lo-Boy". Easily installed with a minimum of service . . . this new "Lo-Boy" gives clean, efficient, low cost heat for homes, offices or shops.

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- Gas Ranges

Empire Stove Co.
BELLEVILLE, ILLINOIS

Manufacturers of Gas Heating and Cooking Appliances

DUO-THERM DIVISION, MOTOR WHEEL CORP., Lansing, Mich.

MODEL: Mayfair No. 1101.

DESCRIPTION: This furniture-styled model has a louvered front. Its capacity is 23,000-Btu input. This heater, and three other models recently introduced by the company, feature the Duo-Therm "Equaflame" burner and extra-large, seam-welded heat chambers and economizers. A flexible draft diverter allows for either a horizontal or vertical flue installation and is included as standard equipment.

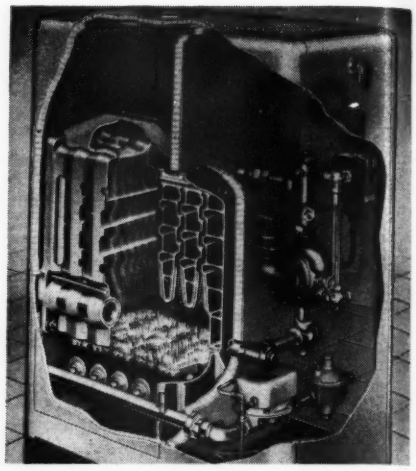
Boilers

THE NATIONAL RADIATOR CO., Johnstown, Pa.

MODEL: Series 22 gas boiler.

APPLICATION: For small residential heating installations.

DESCRIPTION: This new series is AGA-approved for use with all gases and is available in six sizes having net ratings ranging between 110 and 390 sq ft of steam radiation or 175 and 625 sq ft of hot water radiation.



A compact, steel jacket encloses the boiler sections, all controls, and the draft diverter. Raised-port cast iron burners, safety pilots, and all other controls may be reached for servicing through two access doors. These boilers feature three nipples instead of the usual two for joining the cast iron boiler sections.

* * *

TIMKEN SILENT AUTOMATIC DIVISION, Jackson, Mich.

MODEL: TSA gas boiler.

APPLICATION: Built primarily for small homes.

DESCRIPTION: The unit consists of a wall-flame monoport burner and copper tube boiler equipped with maze-type baffles for maximum heat extraction, plus all the necessary controls. The output rating is 80,000 Btu at boiler outlet.

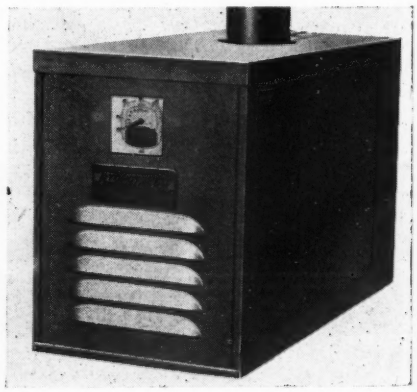
When the boiler is equipped with an external water heating coil and circulating pump (available as optional equipment), domestic water may be heated the year around.

* * *

HOOK & ACKERMAN INC., 18 E. 41st St., New York.

MODEL: Hydrotherm 2HW2 midget hot water heating plant.

APPLICATION: Radiant, convector and baseboard heating systems in three- to six-



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Butane-Propane for Stand-by Plants and Peak-Load Requirements

From our strategically-located plants we are able to give quick delivery on high-quality ANCHORGAS, Butane-Propane. Shipments by rail, water or transport. For dependable gas service, call us before you renew your contract. Ask about Anchor's contract plan.

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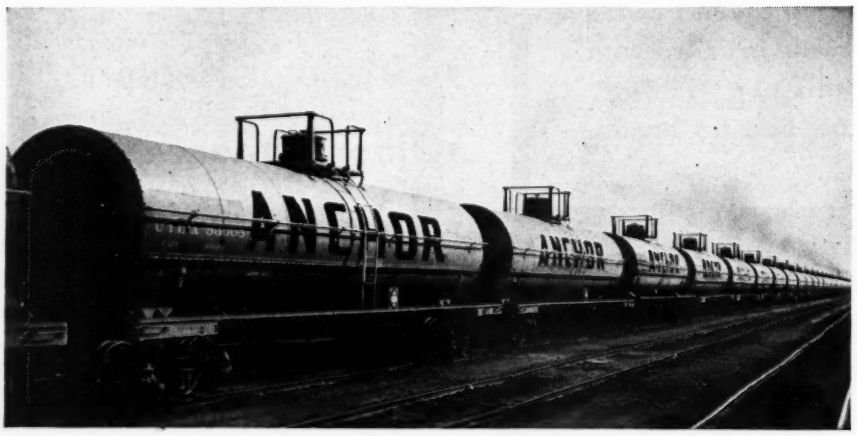
ANCHOR PETROLEUM CO.

ATLAS LIFE BUILDING—TULSA, OKLA.



July, August & September is "Clean Sweep" Time

For extra rewards, extra sales, extra gas load—tie in with this big AGA-Servel Contest

The time is now. The dividends are big. And they're all *yours*. The great "Clean Sweep" Quarter is underway. And it's a made-to-order promotion for pepping up your retail sales . . . for stepping up your gas load.

The rewards are bigger, better than ever. Every month, special cash prizes are awarded to top salesmen. A lot more money will be divided up at the end of the contest on September 10. Then there are desk trophies . . . plaques . . . handsome personal jewelry sets . . . and, best of all, a wonderful Vacation Trip for leading salesmen and representatives from winning Gas Companies.

Everything is all set up for you. All you have to do is be sure your company and your salesmen are enrolled. And don't worry if you had to miss the earlier "Jet Freeze" Contest that marked the first half of this exciting "Big Six" Sales Campaign. You can still clean up in the "Clean Sweep" Contest. And to help you win, Servel has a raft of sales promotion aids. Details will be rushed to you. Write Servel, Inc., Evansville 20, Indiana.

Servel *The GAS Refrigerator*

room apartments and small homes.

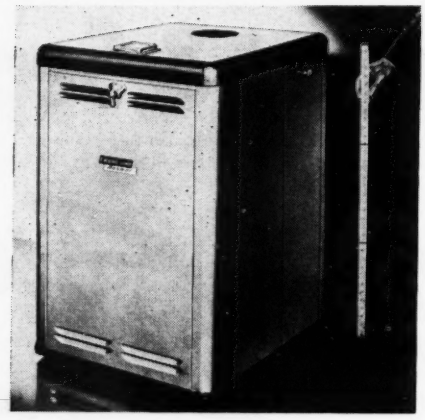
DESCRIPTION: This 13 x 26 x 17 in. unit may be suspended from the ceiling or placed on a shelf. It comes completely assembled and does not require any electrical connection. It has an AGA input rating of 45,000 Btu and will supply 188 sq ft standing radiation. This model weighs 160 lb.

* * *

BASTIAN-MORLEY CO. INC., LaPorte, Ind.

MODEL: Crane-Line Basmor 2-WG Deluxe boiler.

APPLICATION: Because it is completely enclosed, this model is particularly suitable for installation in finished basements and playrooms.

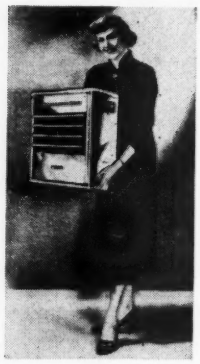


DESCRIPTION: The AGA-approved 2-WG is completely assembled at the factory and includes the following equipment: Basmor gas valve with hydraulic limit control, relay gas valves and recycling manual control switch, transformer, completely automatic shutoff (thermostatic pilot), gas pressure regulator, manual shutoff valve, heavy insulation, and draft diverter.

Unit Heater

REZNOR MANUFACTURING CO., Mercer, Pa.

MODEL: Cadet gas unit heater.



APPLICATION: The Cadet is designed for housing projects, apartments, offices, and shops, as well as garages, attics, basements, and cottages.

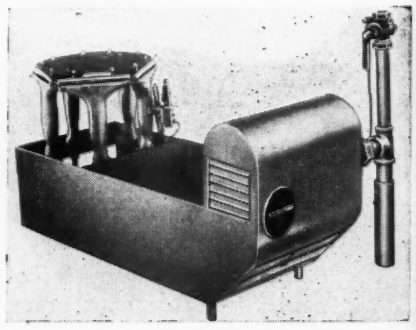
DESCRIPTION: This heater is said to be the smallest suspended gas heating unit on the market with all the automatic features of the forced circulation type of unit heater. The Cadet is equipped with two speeds; its higher speed moves large masses of air for summertime circulation, and when the switch is turned to winter position, the automatic fan control is brought into synchronization with the operating cycles of the heater. Dimensions are 18¾ in. wide x 22¼ in. high x 11⅜ in. deep.

Conversion Burner

INTERNATIONAL OIL BURNER CO., Gas Division, 3800 Park Ave., St. Louis, Mo.

MODEL: 5R conversion burner.

DESCRIPTION: Specially designed gas ports allow the flame to be completely surrounded by air. In addition, the 3/16 x 5¾-in. slotted ports are designed to direct heat toward the furnace walls by means of combustion air. Baffles are eliminated. Since the



flame is directed toward the combustion chamber walls by combustion air, which can be regulated by means of shutters on the burner cabinet, it is not necessary to plaster the burner in the combustion chamber.

AGA-approved, the burner is available in 100,000, 150,000, and 200,000 Btu input sizes. Included are an automatic safety pilot and gas control valve and an air door which allows the secondary air adjustment to remain stationary when the cover is removed.

STOP LOSING MONEY

with dried-out packing...use "CARBOSEAL"

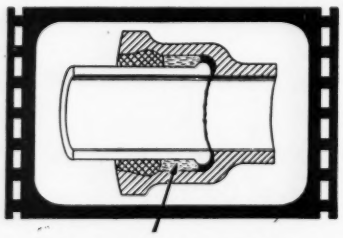
Trade-Mark

ANTI-LEAK

There are no two ways about it. You can't bill anybody for escaped gas. If you're losing your product, you're losing *money—and* running the risks of killing foliage or starting fires! But, with CARBOSEAL anti-leak, you can stop losses caused by dried out fiber packing.

CARBOSEAL anti-leak saturates bell-and-spigot joint packing of dry gas distribution systems and swells the fibers as much as 44 per cent. Joints treated this way 15 years ago are still gas-tight. CARBOSEAL wets down rust or dirt in the mains, and reduces service calls due to pilot outages.

You don't have to uncover every joint! Where mains are graded, all you do is pour in CARBOSEAL anti-leak at high points. Level sections are easily treated with hose and nozzle. In either method, as much as 300 ft. can be reached through one opening. The approximate cost of CARBOSEAL anti-leak to treat one mile of three-inch equivalent main by these methods is less than $100.00 —a good investment.



SEE HOW IT'S DONE!

You can see exactly how CARBOSEAL is used in both the gravity and spray methods as they were filmed during actual operations. The 16-mm. silent color-movie, "CARBOSEAL Anti-Leak Methods of Application" can be borrowed without charge.

"Carboseal" is a registered trade-mark of Union Carbide and Carbon Corporation.

CARBOSEAL ANTI-LEAK

Carbide and Carbon Chemicals Division
Union Carbide and Carbon Corporation
30 East 42nd Street UCC New York 17, N. Y.
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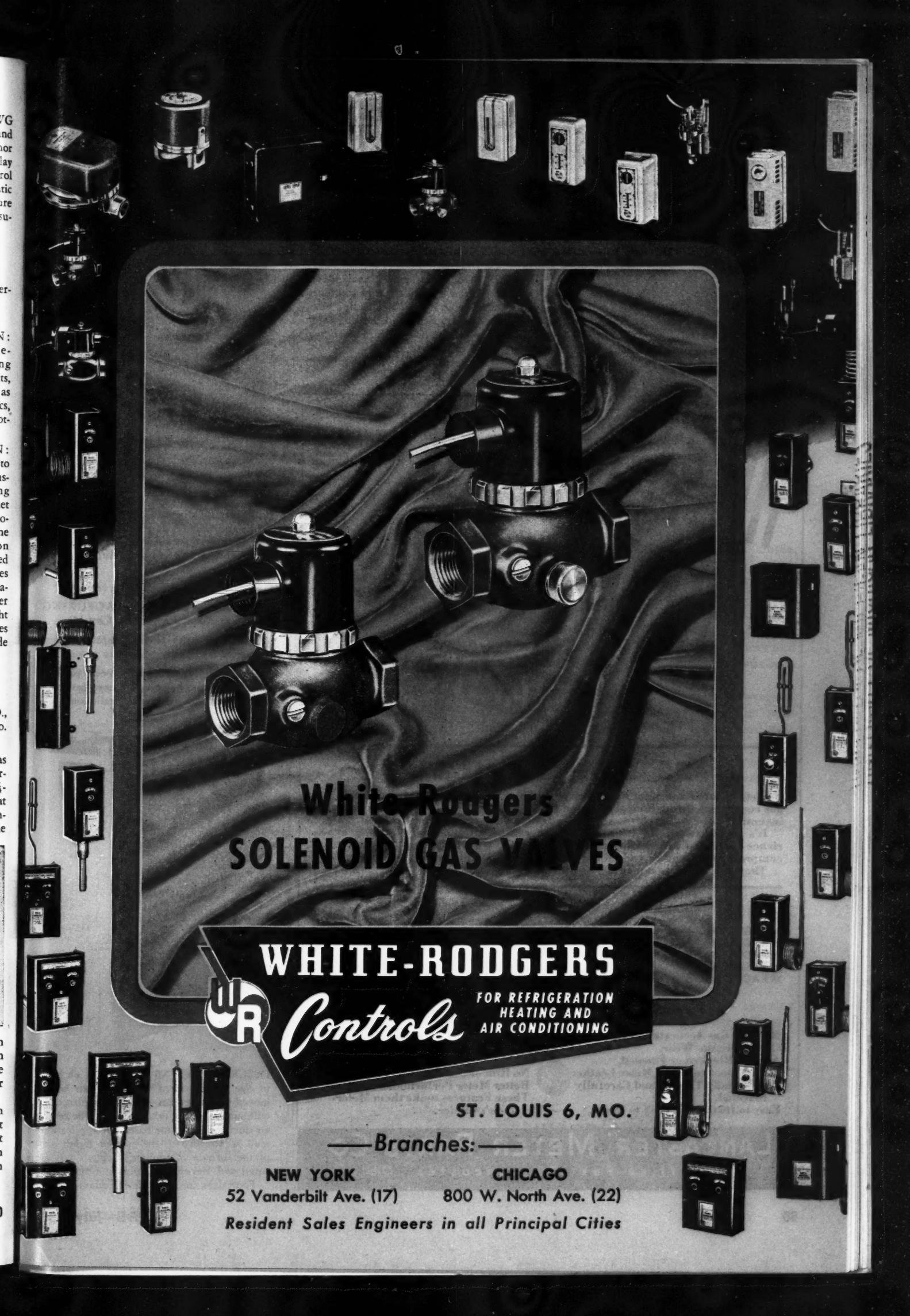
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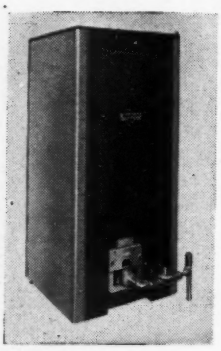
Central Furnaces



ARMSTRONG FURNACE CO., Columbus, Ohio.
MODEL: Gas-fired gravity furnace.
DESCRIPTION: Designed for easy installation, the new unit has an extended cabinet which has the same effect as a built-in warm air plenum. The 85,000-Btu unit is shipped completely assembled while larger models are assembled on the job. Burners are "Quiet Fire" single port type, featuring symmetrical shape for durability. Units are AGA-approved.

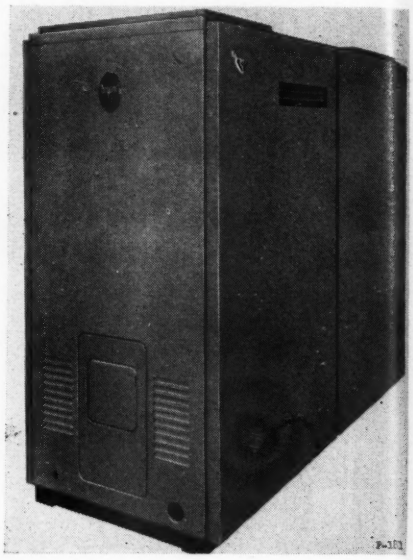
* * *

BRYANT HEATER DIVISION, Affiliated Gas Equipment Inc., 17825 St. Clair Ave., Cleveland 10, Ohio.

MODEL: 576 All-Weather Conditioner.

DESCRIPTION: This model, available in two sizes—3-ton cooling capacity combined with heating input up to 150,000 Btu/hr or 1½-ton cooling capacity with heating input up to 100,000 Btu/hr—is shipped in two sections, each factory assembled.

Two-stage heating is provided with high stage, low stage, and reheat burners. The unit permits selective control of temperature and humidity by means of a thermostat and a humidistat contained in one room control—the Comfortstat. A fan switch, included in the Comfortstat, provides the optional feature of supplying air for constant ventilation.

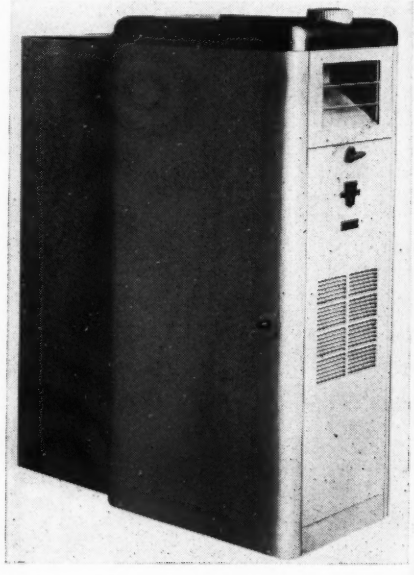


* * *

THE SECURITY MANUFACTURING CO., 1640 Oakland St., Kansas City, Mo.

MODEL: Security Hi-Lo combination gas furnace.

APPLICATION: This two-in-one package unit is sized and balanced to serve basement (illustrated) or closet-type installation.



DESCRIPTION: All controls are enclosed in one compartment, and each can be removed for inspection, repair, or replacement without disturbing other wiring. The return air duct connector for basement applications may be attached to the rear or either side of the furnace. Complete circulation is assured with the electrically driven blower.

Four sizes are available for quantity ship-

METAL RIM

LMPCO

DIAPHRAGMS

25 YEARS AHEAD

Metal Rim Diaphragm Superiority has been proven over and over again by gas companies throughout the United States and Canada. Never before has any invention done so much towards the advancement of gas measurement.

It's an old story, but true—Perfection can be attained only by long experience combined with quality materials and expert workmanship. You make no compromise with quality when buying Metal Rim Diaphragms.

They are 25 years ahead of all others.

FOR

SPRAGUE No. 1-A
SPRAGUE No. 1-D
SPRAGUE No. 2
SPRAGUE No. 3
SPRAGUE No. 5

IRONCLAD No. 1
TOBEY No. 1
Iron Case
Gas
Meters

ALSO:
All-Leather for TOBEY-A
TOBEY No. 2
IRONCLAD No. 2

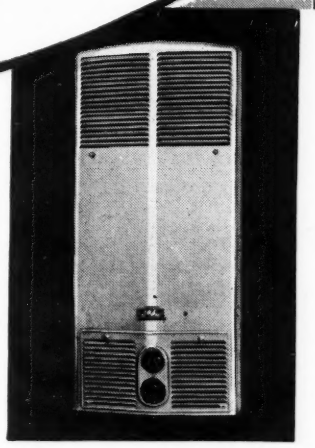
METAL RIM DIAPHRAGMS

Measure Gas Accurately,
Give Twice the Wear,
Are Not Blocked or Formed,
Made from the Finest Meter Leather Especially Tanned and Carefully Selected,
Easy to Install and Easy to Prove,
Oiled with LMPCO Oil which stays in the Leather Through a Ten Year Period,
No Rim or Port Hole Leaks,
Better Meter Performance,
These Features make them Metermen's Choice.

LANCASTER METER PARTS CO.
Post Office Box 378 Lancaster, Ohio

Only STEWART-WARNER "SAFETY-SEALED" Units bring *all* these advantages to *Zone-Controlled* Gas Heat!

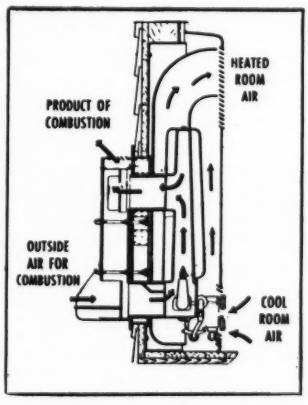
- Small, compact units applicable to one room, a suite of rooms or an entire building!
- All combustion products vented directly through a safety-sealed, exterior wall vent!
- No room air is used for combustion!
- Dependable, low-cost *zone-heating* with manual or thermostat control!
- Easily recessed into walls of wood, brick, plaster, stucco or cement-block construction!
- Rated inputs from 14,000 to 31,000 BTUs per hour!



2 model sizes assure the best possible answer for most heating requirements. Handsomely styled to suit any interior. The inside wall panel is available in Ivory, Beige or Aluminized finish.

Model 991-14 14,000 BTU/HR
18" x 24" x 4"

Model 992-20 20,000 BTU/HR
18" x 38½" x 4"



Exclusive "Safety-Sealed" design positively seals all fuel gas, flame and flue gases from contact with heated room air. "Safety-Sealed" exterior vent draws all combustion air from outdoors, vents all combustion products outside *through the wall!* Interior wall panel extends only 4 inches from the wall surface. Connects directly to the small exterior wall vent.

This "Safety-Sealed" *Saf-Aire* model, for example, is a completely independent, automatic gas heating system that provides safe, reliable heat for an entire building, remote zone, or a single hard-to-heat room.

Every room or zone is heated to its individual requirements with new convenience, comfort and economy *unattainable* with conventional-type central heating plants.

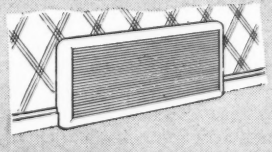
Exclusive "Safety-Sealed" construction *seals* all combustion air and products from contact with heated room air. The patented exterior wall vent draws in *outside* air for combustion, then vents all combustion products outside.

Easy to install in any exterior wall, this versatile "packaged" heating unit needs no chimney, ducts *or electricity!* Only one utility connection is required—the gas line. No basement, closet or floor space is wasted.

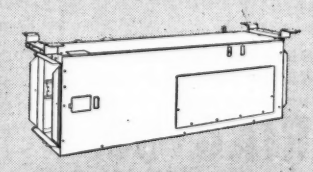
Now available with manual or thermostat control, Saf-Aire operates with equal dependability and silence on natural, manufactured or LP gas. Just set each unit for the desired level of heat, then forget it!

WRITE NOW for complete, free information and specifications on the complete line of Stewart-Warner "Safety-Sealed" Gas Heating Systems. Address inquiries to 1529 Drover Street, Indianapolis 7, Indiana.

These Stewart-Warner Heaters are "Safety-Sealed," Too!



SOUTH WIND ZONE HEATING SYSTEM
Easily installed in any inside or outside wall. Two suitcase-size units heat average home. Automatically modulated forced-air heat. Thermostat control.



SOUTH WIND ZONE FURNACE
Compact, forced-air unit. Easily tucked away under the floor, in a closet or any convenient space. Short ducts from centralized installation. Thermostatic control.

Approved by American Gas Association

STEWART Safety Sealed WARNER
DOMESTIC HEATING

ment, with Btu inputs of 62,500, 80,000, 100,000 and 125,000. Automatic controls and filters are included.

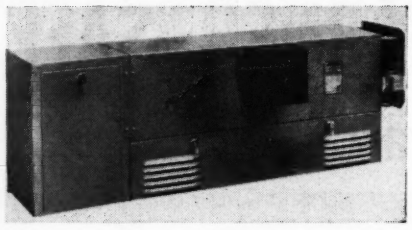
* * *

INTERNATIONAL SALES CO., 2045 Evans Ave., San Francisco.

MODEL: No. 90FB Flat Boy.

APPLICATION: Designed to meet job requirements where conventional furnaces will not fit, this unit requires a low horizontal space such as the attic or sub-floor area in an ordinary house.

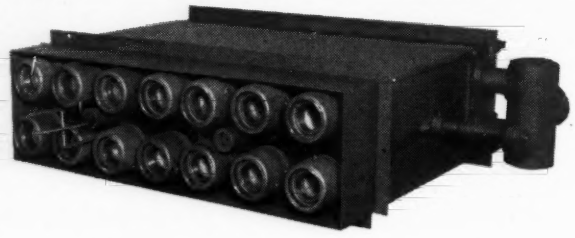
DESCRIPTION: AGA - approved for use with natural, manufactured, mixed, and LP-Gas, this forced air furnace is 25½-in. high x 17 in. wide x 80 in. long. Choice of draft diverters is available—4-in. or 5-in. outlet, horizontal or vertical in either size. Entire



unit can be reversed for air flow from right to left, or vice versa, easily and quickly on the job. Burner and control assembly may be removed from the furnace for servicing.

The company's "cross fire pilot" system, which requires that a pilot flame be established at each multiple burner before gas can be admitted to those main burners, is featured.

WEBSTER KINETIC*



GAS BURNER

- Designed for LOW GAS PRESSURE
- Will operate at ONE POUND
- Will TURN DOWN to ½" Water
- Fires a SCOTCH MARINE BOILER without a dutch oven or refractory lining
- Will operate through a FIRE DOOR
- Will NOT VIBRATE
- Draft Loss VERY LOW
- This Gas Burner is available in ANY SHAPE and SIZE
- INTEGRALLY MOUNTED pilots

For WEBSTER KINETIC BURNER Information Write—

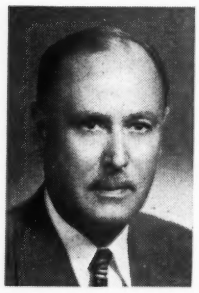
THE WEBSTER ENGINEERING CO.

P.O. BOX 2168 • TULSA, OKLAHOMA

*Trade Mark

PEOPLE

A. E. HIGGINS, prominent gasman, recently was appointed to the newly created post of manager, utility relations, of General Electric's air conditioning department. Before the appointment, Mr. Higgins was vice president of Rockwell Manufacturing Co.'s international division in New York. He has been associated with the gas industry since 1927 with time out for extensive service during World War II. Mr. Higgins became associated with the American Gas Assn. in 1928 and was active in building, equipping, and promoting the Cleveland laboratory. In 1931 he was appointed secretary of the AGA Natural Gas Department. He resigned to become vice president of Pittsburgh Equitable Meter Co. and Merco Nordstrom Valve Co. (later merged to form Rockwell Manufacturing Co.).



A. E. Higgins

W. M. HENDERSON, superintendent of distribution, central division, Southern California Gas Co., Los Angeles, retired June 1 after 26 years with SoCal and a predecessor. Mr. Henderson began his career as an office boy for California Central Gas & Electric Co. in San Francisco. He served as clerk, construction crew laborer, gas maker, draftsman, plants manager, assistant engineer, and finally gas distribution engineer of the entire Pacific Gas & Electric Co. system. He joined SoCal's predecessor, Los Angeles Gas & Electric Corp., in 1924.

HENRY HARMAN on June 9 completed his 57th year with Milwaukee Gas Light Co. Mr. Harman is 80 years old and has been purchasing agent for the past 50 years. He will still do consulting work for the company on call. Another recent retirement was that of FRED B. CADMUS, assistant manager of the gas production department for Consolidated Edison Co. of New York Inc. Mr. Cadmus had been associated with the company for nearly 24 years and had held the position from which he retired since 1945.

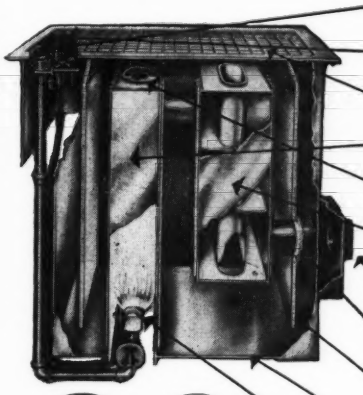
JOSEPH VAN ACKEREN, vice president and assistant general manager of the engineering and construction division of Koppers Co. Inc., Pittsburgh, since 1930, recently retired. The company will retain his services as a consultant. GEORGE M. CARVLIN, a vice president of the division, has been named assistant general manager.

HARRY M. EVANS, formerly affiliated with Standard Oil Co., Fluor Corp., and Southern California Gas Co., has been named manager of the San Francisco branch of A. O. Smith Corp., Milwaukee. He replaces J. J. STAHL who was appointed assistant western sales manager of the A. O. Smith Motor Division at Los Angeles.

WARD STAINLESS STEEL FLOOR FURNACES

The new Ward *Stainless Steel* Furnaces combine time-tested exclusive Ward features with major new improvements that assure maximum heating efficiency, long furnace life and economy of operation.

20 YEAR GUARANTEE against burning out or rusting out.



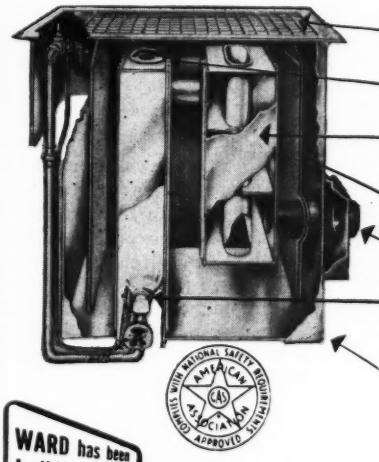
- Bilt-in Thermo Control
- 100% type safety pilot on automatics
- Heavy, close mesh fabricated register
- Stainless Steel combustion chamber
- Brass screw type lighter door
- Copper bearing, steel radiation chamber
- Copper nipple on draft diverter
- Asbestos vent tube insulator
- Asbestos insulated inner shell
- Asbestos insulated outer shell
- Slotted blue flame Bunsen burner

WARD STANDARD FURNACES

QUALITY BUILT FOR TOP PERFORMANCE

Here is a furnace packed with value! Backed by Ward's 41 years' experience, the Standard Furnace gives you quality features not found in any other furnace in the same price range.

10 YEAR GUARANTEE



- Heavy fabricated floor register
- Sealed lighter door—brass screw type
- Copper bearing steel heating element—18 gauge steel
- Radiation shield surrounds inner shell
- Copper nipple on draft diverter
- Cast iron slotted Bunsen type burner
- Galvanized iron outer casing

WARD has been building quality floor furnaces for 41 years...

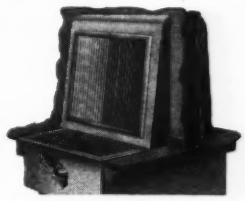
Write for 40 page catalog

WARD HEATER CO. · 1800 W. WASHINGTON BLVD. · LOS ANGELES 7

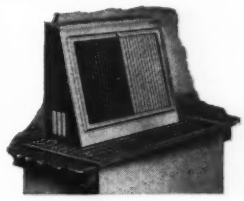
A CORRECT TYPE OF WARD FURNACE FOR EVERY NEED

Ward Furnaces are available in two types: *Stainless Steel* and *Standard*. The *Stainless Steel* Floor Furnace models are available with the exclusive Bilt-in Thermo Control or with wall type or manual controls. All other models are available with manual or wall type automatic controls. A wide range of heating capacities to fit all needs. The Ward does a complete heating job, or can be used for auxiliary heat.

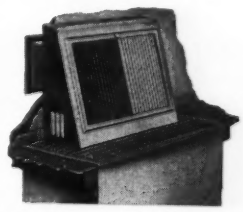
FLOOR FURNACE—Six Models 20,000 to 70,000 B.T.U.



DUAL FURNACE—Four Models 27,500 to 55,000 B.T.U.



SINGLE REGISTER FURNACE—Two Models 20,000 and 27,500 B.T.U.



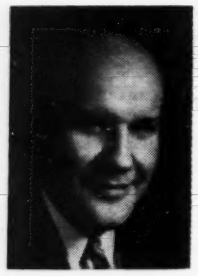
BATHROOM REGISTER FURNACE—Two Models 20,000 and 27,500 B.T.U.

EASY TO INSTALL

- Shallow construction eliminates necessity of a pit.
- All models can be installed from floor level.

EASY TO SERVICE

- Controls are serviceable from top of furnace—no need to crawl under house.
- Removable burner assembly—just unscrew two wing nuts and lift out burner pan.



M. W. Elert
... Detroit

H. J. Schneider
... Rockwell

Jack H. Mikula
... Milwaukee

J. J. Wittmer

E. L. Griffith

C. B. Delafield

... Consolidated Edison Co. of New York

M. W. ELERT has been promoted to assistant sales manager of Detroit-Michigan Stove Co. and E. C. BARROWS has been named to succeed him as advertising manager. Mr. Elert was head of the sales order department and in 1949 became advertising manager. Mr. Barrows was associated for 16 years with the Norge Division of Borg Warner Corp., the last 10 years as advertising manager.

HARRY J. SCHNEIDER has been appointed by Rockwell Manufacturing Co., Pittsburgh, to assist D. L. Jerman in sales work in the state of New Jersey. Mr. Schneider was previously employed in the gas engineering department of Stone & Webster Service Corp.

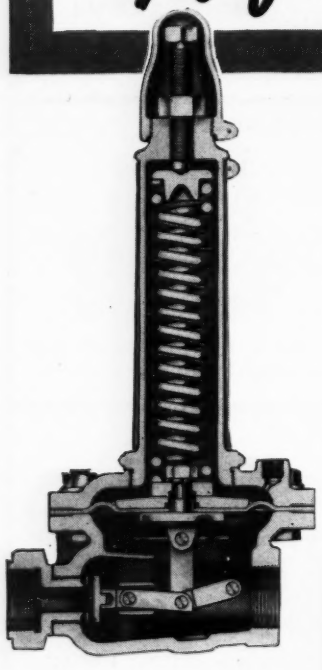
JACK H. MIKULA, an employee of Milwaukee Gas Light Co. for nearly 20 years, has been named general sales manager and assistant to B. T. Franck, vice president in charge of sales. While attending the University of Wisconsin, Mr. Mikula was employed by the utility during vacation periods. After graduation he worked as a cadet engineer in various departments until 1939 when he became supervisor of refrigeration service and installation. Later he held the positions of refrigeration engineer in the commercial sales department, industrial engineer in the industrial and commercial department, and assistant manager of the latter department.

DR. JOHN J. WITTMER, EARL L. GRIFFITH, and CHARLES B. DELAFIELD have been elected vice presidents of Consolidated Edison Co. of New York Inc. Dr. Wittmer, who has been an assistant vice president since 1946, has been identified throughout his ConEd career with various phases of employee relations. Direction of the company's construction, maintenance, and shops program is handled by Mr. Griffith, who has been an assistant vice president for the past decade. Mr. Delafield's responsibilities, which have encompassed corporate finance and advertising, were recently extended to include commercial relations.

HENRY D. DUSINBERRE has been named assistant purchasing agent in charge of stores for The Manufacturers Light & Heat Co. and associated companies in the Pittsburgh Group of Columbia Gas System. Mr. Dusinberre has moved to Pittsburgh from Binghamton, N. Y., where for 15 years he has been in charge of purchases and stores for three Pittsburgh Group companies — Binghamton Gas Works, Keystone Gas Co. Inc., and Home Gas Co.

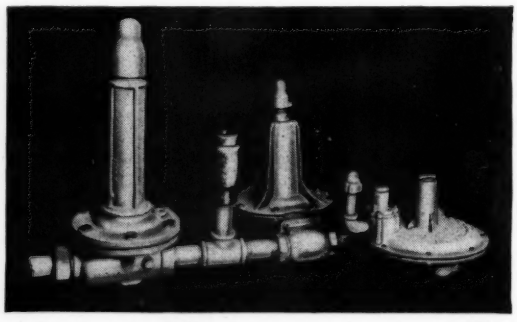
H. N. OLDHAM has been appointed assistant operating manager of Southern Union Gas Co. and has moved from Carlsbad, N.M., to the home office in Dallas. For 13 years Mr. Oldham was district manager for Southern Union in southeastern New Mexico.

IN THE HIGH PRESSURE FIELD
THERE IS SAFETY
IN *Reynolds* ...



Accurate, Safe Control

of tremendous pressures is an ever present problem in the gas field. Reynolds field Regulator illustrated at left is one of the many high pressure regulators built by Reynolds. It is thoroughly tested and proved in service. It handles up to 1,000 pounds safely reducing same to pounds. For more than fifty-five years Reynolds has designed and built gas regulators. Safety, accurate performance, years of service—these are some of the built-in factors responsible for Reynolds enviable position in the Gas Control Field.



Reynolds Gas Regulator Co.
ANDERSON, INDIANA, U. S. A.
GAS CONTROL SINCE 1892

SECURITY

MODEL SFA AUTOMATIC GAS-FIRED

HI-LO COMBINATION

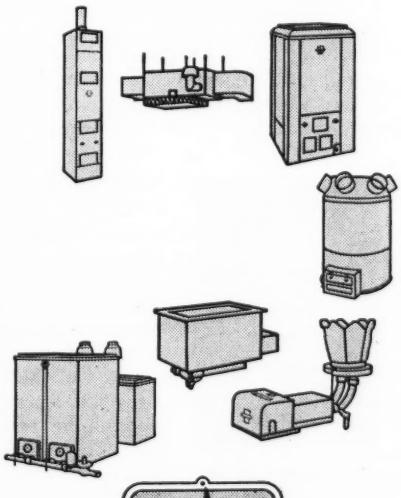
Now...The TWO-IN-ONE Furnace

FOR CLOSET INSTALLATION

FOR BASEMENT INSTALLATION

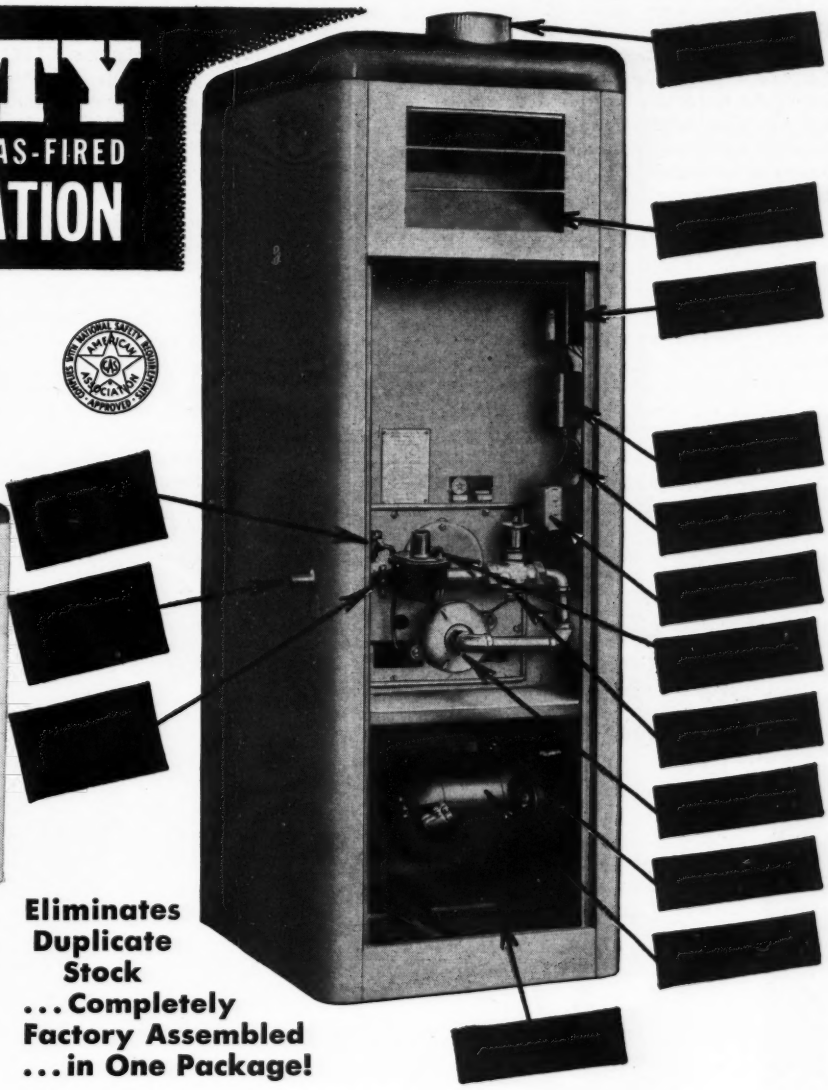
INPUT

4 SIZES—62,500 BTU 80,000 BTU
100,000 BTU 125,000 BTU



SECURITY

The LONG-LIFE Line



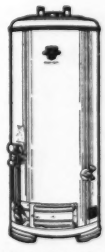
Eliminates Duplicate Stock ...Completely Factory Assembled ...in One Package!

Yes, sir . . . TWO-IN-ONE because only standard Security SFA Furnaces need be kept in stock. Factory-assembled and wired to serve in closet-type or usual basement-type installations. Return air duct connector for basement application is shipped knocked down . . . can be attached to the back or to either side in a matter of minutes.

Simple to Service . . . Easy Access

All controls are located in one compartment. Quick, accurate adjustments . . . easy replacements are expedited without disturbing other wiring. Built-in filter racks can be placed at installer's option.

Built of top-quality materials throughout. Complete information, specifications, prices and discounts available. Write today!



Builders of the famed Security Heavy Duty Water Heaters!

SECURITY MANUFACTURING CO.

1630 Oakland Ave. Kansas City 3, Mo.

FRANK N. SEITZ took over June 1 as manager of sales for Southern Counties Gas Co., Los Angeles. The position was left vacant by the recent death of Floyd S. Parmenter. Mr. Seitz formerly was general supervisor of appliance sales and promotion for Southern California Gas Co., SoCounties' affiliate.

DONALD L. BARGER has succeeded CARL A. SPENCER as superintendent of The Peoples Natural Gas Co.'s (Pittsburgh) Armstrong field district, which includes four communities. Mr. Barger was formerly assistant superintendent in the district. Mr. Spencer will be transferred to another district. Peoples Natural also announced the appointment of WALTER LOWE as supervisor of utilization engineers and PAUL E. BEECH as supervisor of dealer relations. LEO R. NUHFER, the company's safety director, recently was elected general chairman of the American Society of Safety Engineers' western Pennsylvania chapter.

D. A. HULCY, Lone Star Gas Co. president, was awarded an honorary Doctor of Laws degree at the May graduation exercises of Texas Wesleyan college in Fort Worth . . . DR. HAROLD VAGTBORG, president of Southwest Research Institute, San Antonio, received a Doctor of Laws degree at the June 4 commencement at Missouri Valley college in recognition of his "record of service in the field of vital research."

THE TAGLIABUE Instruments Division of Weston Electrical Instrument Corp., Newark, has appointed the following district sales representatives who now handle both the Weston and Tag lines: C. L. HUFFMAN, Russell F. Clark Co., Pittsburgh; E. F. SCHIMBOR, Herman E. Held, San Francisco; R. C. STAUB, Beedle Equipment Co., Cincinnati; G. O. MILLER, Schiefer Electric Co. Inc., Syracuse; T. J. CUNERTY, Powerlite Devices Ltd., Toronto; A. R. HOUGH CO., Knoxville; EDWARD S. SIEVERS, Los Angeles; T. S. CAWTHORNE CO., Detroit; EICHER & CO., Seattle; WARD ENGINEERING CO. INC., Orlando and Jacksonville; W. J. KELLER, New Orleans; and W. H. DITTMAN, Cowperthwait & Brodhead, Boston.

ARCCO
NEW
ARCCO-ANUBIS
Laboratory
GAS
BALANCE
SMALL SAMPLE—WIDE SPECIFIC GRAVITY RANGE
No manometer, vacuum pump, air drier
or other complex accessories required
This instrument is identical in principle to the well known ARCCO-ANUBIS recording type dry air gas gravitometer. For laboratory use only, this beautiful instrument is ideal for testing samples brought in from the field. Unusually small gas sample is required.
Handles specific gravity range from .5 to 1.5 and by the use of weights a total range from .0 to 2.5.
AMERICAN
RECORDING CHART CO.
3113 E. 11th St. • Los Angeles 23, Calif.
SEND FOR CATALOG
No. 101R
ARCCO-ANUBIS
Gas Gravity Instruments
SEND FOR BULLETIN 101R

- OBITUARIES -

Samuel Klein

SAMUEL KLEIN, 95-year-old founder of Caloric Stove Corp., Philadelphia, died May 22. Born in Germany in 1855, he came to this country and started his stove business in 1890, remaining active in the management of it until about nine years ago. A pioneer in employee relations policies, Mr. Klein maintained a shop in downtown Philadelphia long after plant facilities had been moved simply because it was a haven for long-time employees. On the celebration of his 50th year in business Mr. Klein still had one employee who had been hired at the start and another who had been employed 43 years. Caloric is now managed by his five sons.

LAURENCE O. SECORD, acting director of the gas appliance promotion division of Ketchum, MacLeod & Grove Inc., Pittsburgh advertising agency, died on May 29. Mr. Secord was editor of the division's monthly publication, *Gas Appliance Dealer*.

Burgess Manchester

BURGESS MANCHESTER, 57, consulting engineer for Metropolitan Utilities District, Omaha, died on May 25. Mr. Manchester had completed 30 years of service with the company last March although he retired from active duty in November 1948 because of illness, and was retained as consulting engineer. He had joined Metropolitan in 1924 as assistant to C. D. Robinson and became operating engineer when Mr. Robinson retired.

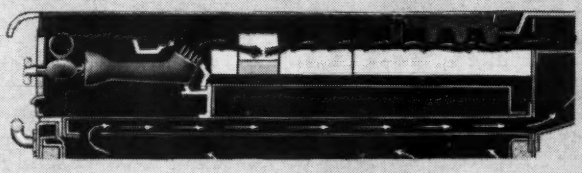
O. C. WATERS, assistant chief engineer for Atlanta Gas Light Co., died May 27. Mr. Waters joined the company in 1929 and served as general superintendent before becoming assistant chief engineer.

1 ★ 2 ★ 3 ★ 4 ★ 5 ★ 6 ★ 7

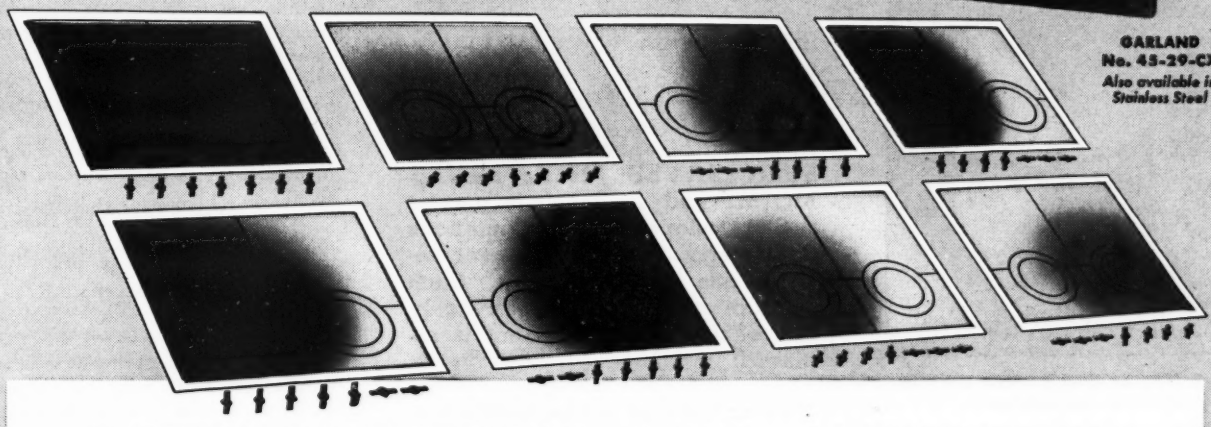
Front Fired Burners Give Unequaled Top Heat Flexibility! ONLY

GARLAND

the leader Has This Feature



GARLAND
No. 45-29-CX
Also available in Stainless Steel



GREATEST FEATURE ON ANY HEAVY DUTY GAS RANGE! *Seven front fired burners* that distribute controlled heat to every part of the cooking top! *Seven front fired burners* that permit an infinite number of heat variations all over the hot top.

Yes, Garland—and *only* Garland—has this great feature! Garland is the most flexible, the most practical of all Heavy Duty gas ranges!

Think of the time saved—think how *much faster,* how *much better* the chef can prepare meals when he has the right degree of heat when he wants it, *where* he wants it.

And remember: this is only one of the many big features that make Garland the leader in sales, the leader in value! So before you buy, see your Garland dealer! Compare! Your choice will be *Garland!*

AMERICAN SOCIETY OF INDUSTRIAL ENGINEERS — MERIT AWARD

ALL Garland units are available in Stainless Steel and equipped for use with manufactured, natural or L-P gases.

GARLAND*

THE TREND IS TO GAS FOR ALL COMMERCIAL COOKING

Heavy Duty Ranges • Restaurant Ranges • Dinette Ranges • Broilers • Deep Fat Fryers
Toasters • Roasting Ovens • Griddles • Counter Griddles

PRODUCTS OF DETROIT-MICHIGAN STOVE CO., DETROIT 31, MICHIGAN

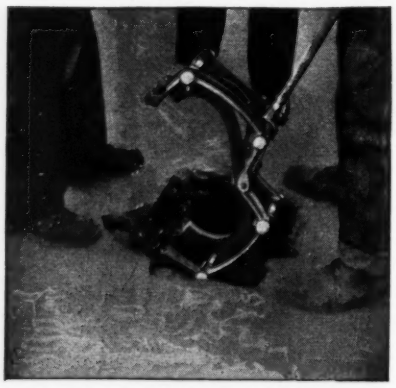
*REG. U. S. PAT. OFF.

A SIMPLE SOLUTION for one of the GAS INDUSTRY'S *most trying problems*

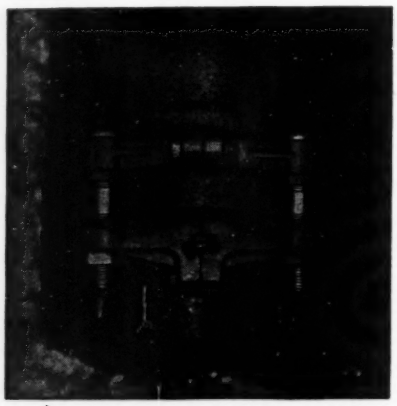
the **NORMAC**

BELL JOINT CLAMP

SOLVES YOUR JOINT REPAIR PROBLEMS



6 inch Normac Clamp being lowered into hole for installation



6 inch Normac Clamp in service after installation

QUICK • EASY • PERMANENT

Installed in small pavement openings. Available in all standard sizes from 3" to 12". A simple set of tools cleans the joint, installs the clamp . . . often in only a quarter of an hour. SAVES TIME. SAVES MONEY and the repair is permanent. Designed for all conditions particularly where pavement repair costs are prohibitive. Such small opening repairs are scarcely noticeable when pavement is replaced.

Normac Clamps can be installed in large as well as small openings.

Norton - McMurray hold definite leadership in the development of methods for installation and rehabilitation work through small openings. We welcome the opportunity to help solve a problem you may have—tell us about it.

Write for our catalog describing our complete line of COUPLINGS . . . FITTINGS . . . SERVICE TEES and ELLS . . . SLEEVES . . . COMPRESSION-END COCKS . . . METER BARS and BRASS FITTINGS for copper pipe.

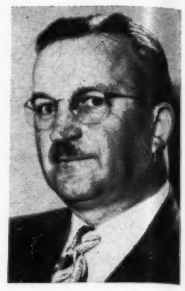
NORTON-McMURRAY MFG. CO.

39 SOUTH LA SALLE ST. • CHICAGO 3, ILL.

Method and product covered by U. S. Patents, Nos. 2,163,261 and 2,178,286.

ASSOCIATIONS

Lyle Harvey



Lee Brand

. . . reported to GAMA

RAISE THOSE SIGHTS

Double range sales quotas, CP men cry

Expanding scope and expanding vistas of the gas industry gripped everyone's imagination as 403 gathered for the 15th annual meeting of GAMA at the Greenbrier hotel, White Sulphur Springs, W. Va., May 28-30.

Highly significant was the resolution adopted by the "CP" Manufacturers Group, in which it was declared that the industry should raise its sights and hit for the sale of 5 million gas ranges a year instead of the current figures of something over 2 million.

The resolution pointed out that:

1. There are more than 27 million homes in the United States using gas for cooking.

2. More than 11¼ million gas ranges in use are more than 10 years old and should be replaced.

3. In 1948, 2¾ milion gas ranges were sold and in 1949, 2⅛ million, but 4 to 5 million a year could be sold profitably through aggressive sales efforts by all parts of the industry.

It was therefore resolved that the "CP" Manufacturers Group bring these facts to the attention of the industry and suggest that industry sales goals be set at the higher level and plans made to carry out this objective.

Hugh H. Cuthrell, AGA president, in a luncheon speech advocated the same goal of 5 million range sales, and declared it was not sufficient to be content with replacing ranges only once in 11 years. The continued existence of such ranges, he declared, is what is leading some people to think that gas ranges are passè.

There's no future, Mr. Cuthrell declared, unless the manufacturers and the utilities work out their problems together and at present "there is too much negative thinking among too many of us."

The present market, Mr. Cuthrell declared, might better be known as a "salesmen's market," rather than a "buyers' market."

Mr. Cuthrell urged that in the battle to expand sales the utilities and manufacturers use every possible resource—"dollars, ideas, technical skill."

H. Carl Wolf, managing director of the AGA, asked his luncheon audience:

"Have you set up an adequate program

of employee education to show them what your product means?"

Mr. Wolf made a plea for a public relations program which would acquaint residents of a community, along with employees with the constructive work of a company, through such procedures as plant visits.

"Are you answering the lies and innuendos thrown at you and other industries today?" he asked.

Featured speaker at the president's dinner, Philip M. Hauser of the University of Chicago, former acting director of the census, described how "Business Can Use the Census."

Frederic O. Hess, Selas Corp., was elected president, succeeding Stanley H. Hobson, of Rockford, Ill., when his term expires Sept. 30.

National advertising by the gas industry needs support at the local level by distributors, dealers and other outlets to insure full potency of the program, delegates were told by Mr. Hobson.

"Without a complete tie-in of brand name advertising at the local level, through gas utilities and dealers alike, we lose the wallop that national advertising should create," he said.

Plans to win the rural, small town and suburban markets beyond city gas mains for liquefied petroleum gas were outlined by Lee A. Brand, Empire Stove Co., chairman of the National Committee for LP-Gas Promotion.

H. Leigh Whitelaw of New York, GAMA managing director, told what makes the association tick.

Lyle C. Harvey, of Bryant Heater Division, chairman of the association's trade show committee, reported that the October GAMA exhibition at Atlantic City has been a space sell-out for more than three months.

Eighteen men were awarded meritorious srevice awards.

Atlantic City Program Shaping Up; 165 To Exhibit

With booth-space reservations and hotel reservations running well above their usual levels, American Gas Assn.'s general convention committee reports an expected attendance at the association's convention in October to break all records.

G. E. Whitwell

Chairman George E. Whitwell, head of the convention planning group, said this month that all exhibition space available had been reserved by appliance manufacturers through the Gas Appliance Manufacturers Assn., and that Atlantic City hotels had reported a large volume of reservation requests for Oct. 2-6, dates of the convention.

Mr. Whitwell, vice president, Philadelphia Electric Co., has completed preliminary plans for the convention program, which will include general and department meetings, social events, and special roundtable sessions on changeover to natural gas and problems growing out of the coming of natural to eastern market areas.

A TERRIFIC HIT!
BETTER MECHANICS PREFER
TOLEDO 1R
THREADER
FOR 1" to 2" PIPE
because
It's ACCURATE!
Perfect threads produced by separate Toledo Dies for each pipe size.
It's EASY THREADING!
Less friction due to famous Toledo receding die principle — small die segments with only a few cutting teeth backed by taper pins.
It's LOW COST!
Simple in design with one ratchet handle.

Do your next 1" to 2" pipe work with a Toledo 1R Threader—the tool that's "tops" with better mechanics! Similar to the famous No. 1 and No. 1A Toledos—but *simpler in design* with one ratchet handle and *low in cost!* A separate set of dies for each size of pipe —1", 1¼", 1½" and 2"—assures longer die life. Each set is hobbed for just the proper clearance. This means easier cutting, smoother, cleaner, more perfect threads and tighter pipe joints! Die change is quick and easy . . . or, many users prefer separate tool for each size. Durable . . . saves job-time . . . reduces costs! Ask your distributor for details and price . . . or send coupon.

RELY ON THE LEADER

TOLEDO

POWER PIPE MACHINES
POWER DRIVES
PIPE TOOLS

SEND COUPON

The Toledo Pipe Threading Machine Co.
Toledo, Ohio

Without obligation, send bulletin No. 650 and price on Toledo No. 1R Threaders, 1" to 2" pipe.

Name.....

Firm.....

Street.....

City.....State.....

CHEMICAL-PRODUCTION MEETING. At dinner meeting of AGA operating section manging committee during New York conference May 22-24, from left, R. R. Van Vliet, section vice chairman, Staten Island, N. Y.; E. G. Campbell, chairman, Chicago; W. R. Fraser, Detroit; George Smith, AGA; A. C. Cherry, Cincinnati.

Gellert Signs Alberta Premier For PGGA Meet

A significant choice—and acceptance—of a keynote speaker for the annual convention of the Pacific Coast Gas Assn. in Seattle July 31 has been made. PCGA delegates will be addressed by Ernest C. Manning, premier of the province of Alberta, Canada.

Premier Manning, from whose territory will come the natural gas that will be sent to major cities in the northwest U. S. when the Canadian parliament has authorized one of the two pipeline plans now pending, accepted a personally delivered invitation by N. Henry Gellert, PCGA and Seattle Gas Co. president, to keynote the convention.

Washington's Gov. Arthur B. Langlie will have Premier Manning as his guest at the governor's mansion during his visit to Seattle.

The PCGA gathering in Seattle marks the first time in 13 years that the association has held its annual convention in that city.

AGA Staffers Hold Roundtable

To the end that each employee shall become better acquainted with his job, his industry, and his country's economic system, the American Gas Assn. has instituted a program of free discussions for its New York staff. First step was taken in May, with the scheduling of three round-table meetings on the gas industry—its origin and evolution, general functions of AGA and other trade associations, and AGA headquarters organization, functions, and policies.

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IF YOU ARE NOT A REGULAR SUBSCRIBER TO **GAS**

In GAS each month you will find dozens of ideas that will help you know your business better and do your job better. Just one of these ideas coming to you on our pages can pay you many, many times the small cost of a subscription.

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LOS ANGELES 4, CALIFORNIA

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Please enter my subscription to GAS for . . .

All Others—1 Year $3 ☐

1 YEAR $2.00 ☐ **2 YEARS $3.50** ☐ **3 YEARS $5.00** ☐

☐ Check is enclosed ☐ Please bill me

NAME_____ POSITION_____

COMPANY_____

STREET CITY ZONE STATE

CALENDAR

JULY

Pacific Coast Gas Assn. 57th Convention—Seattle, July 31-Aug. 3.

SEPTEMBER

New Jersey Gas Assn. Annual Convention—Monmouth hotel, Spring Lake, N. J., Sept. 8.

National Petroleum Assn.—Hotel Traymore, Atlantic City, Sept. 13-15.

Mid-West Gas Assn. 27th Gas School & Conference — Iowa State College, Ames, Sept. 14-15.

Controllers Institute of America Annual Meeting—Edgewater Beach hotel, Chicago, Sept. 17-20.

OCTOBER

AGA Annual Convention and GAMA Exhibition of Gas Appliances and Equipment—Atlantic City, N. J., Oct. 2-6.

Texas Mid-Continent Oil & Gas Assn. Convention—Dallas, Oct. 4-5.

National Safety Congress & Exposition—Chicago, Oct. 16-20.

National Metal Exposition—Amphitheatre, Chicago, Oct. 23-27.

NOVEMBER

National Hotel Exposition—Grand Central Palace, New York, Nov. 6-10.

Wisconsin Utilities Assn. Gas & Electric Section Convention—Schroeder hotel, Milwaukee, Nov. 8-10.

American Petroleum Institute Annual Meeting—Los Angeles, Calif., Nov. 13-16.

American Society of Mechanical Engineers Annual Meeting—Hotel Statler, New York, Nov. 26-Dec. 1.

AGA-SGA Employee Relations Conference—New Orleans, Nov. 27-28.

DECEMBER

The American Society of Refrigerating Engineers—Hotel Commodore, New York, Dec. 3-6.

MARCH 1951

Mid-West Gas Assn.—Hotel Fontenelle, Omaha, March 12-14.

Gas Appliance Manufacturers Assn. Annual Meeting—The Homestead, Hot Springs, Va., March 19-21.

New England Gas Assn. Annual Meeting—Hotel Statler, Boston, March 29-30.

APRIL

AGA Sales Conference on Industrial & Commercial Gas—Sheraton hotel, Washington, D.C., April 2-4.

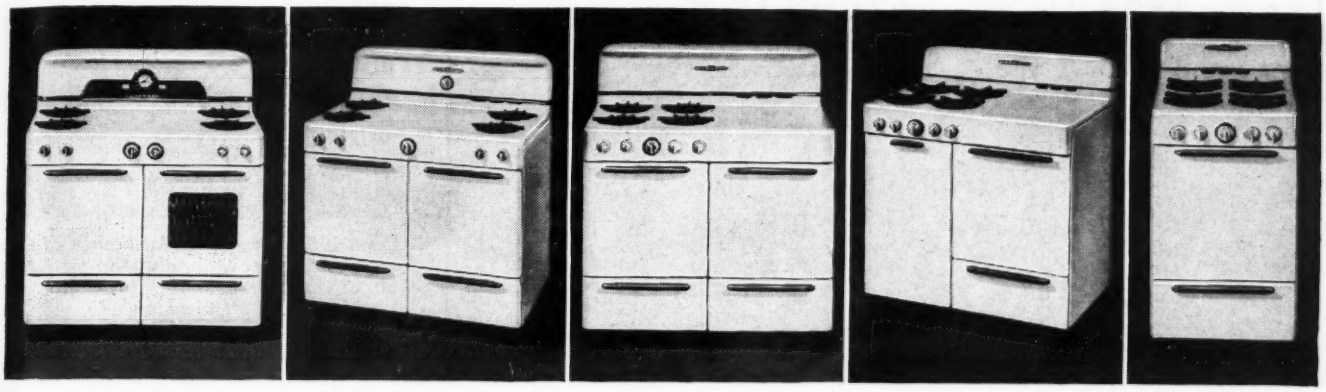
Mid-West Regional Gas Sales Conference, Residential Gas Section—Edgewater Beach hotel, Chicago, April 9-11.

AGA Distribution, Motor Vehicle, and Corrosion Conference—Hotel Peabody, Memphis, April 16-18.

Southern Gas Assn. Annual Meeting—Biloxi, April 23-25.

MURRAY

brings you today's biggest PROFIT OPPORTUNITY!



Model GA-44 Model GA-42 Model GA-40 Model GA-30 Model GA-20

MURRAY

one of the nation's large and well-known manufacturers, with ten years' experience in the production of Home Appliances, now brings your customers all-new GAS RANGES...with seamless burner bowls, "Waterfall" tops, extra-large ovens!

MURRAY

Model GA-44 (see above) has giant 18" x 15" x 20" oven, fully porcelain-enameled with rounded, easily-cleaned corners and concealed drip tray. Features big broiler with smokeless pan and grid that slides out as door is opened. Full control backguard contains 20-watt fluorescent lamp, fine electric clock with interval timer (3 minutes to 4 hours)!

MURRAY

"Waterfall" design top eliminates crevice along front of range—one-piece construction avoids separate burner bowls with seams to catch grease. Oven door has clear-vue window. Big storage drawers. Titanium porcelain enamel—always sparkling white! Welded construction. Fiberglas insulation. Range sizes include three 40" ranges, a 36" and 20" with double-seal oven doors.

IF YOU ARE A WHOLESALER,
kindly write on your letterhead.

IF YOU ARE AN APPLIANCE DEALER,
kindly forward coupon.

G-3

The Murray Corporation of America
Home Appliance Division
Scranton, Pa.

Gentlemen:
Kindly forward full details on your new GAS RANGE LINE.

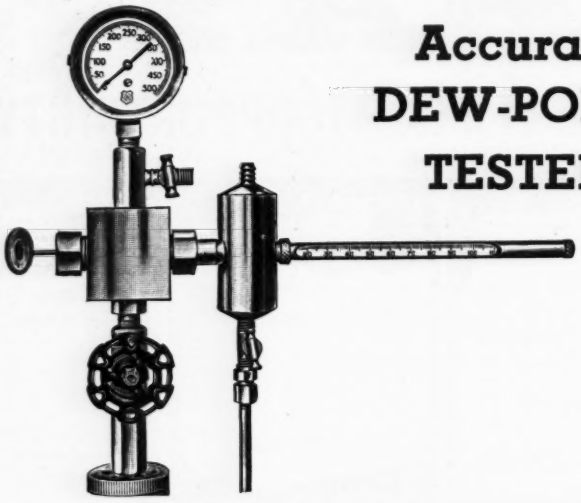
Name_____

Address_____

City_____ State_____ Zone_____

MURRAY

urges you to get full particulars now. Send convenient coupon. Meanwhile watch for further announcements!



Accurate DEW-POINT TESTER

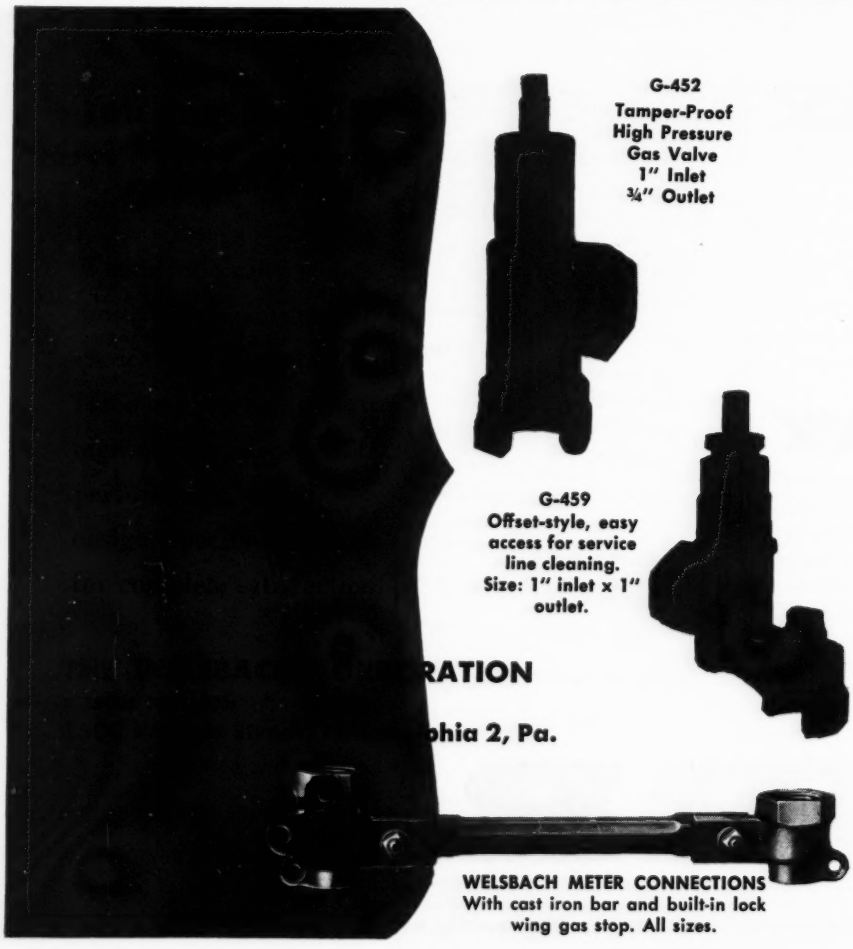
Simple to operate. Dew points can be determined with an accuracy of 0.2F. on high pressure gas transmission lines. Standard Range 0 to 1,000 p.s.i. High Pressure Range 0 to 2,500 p.s.i.

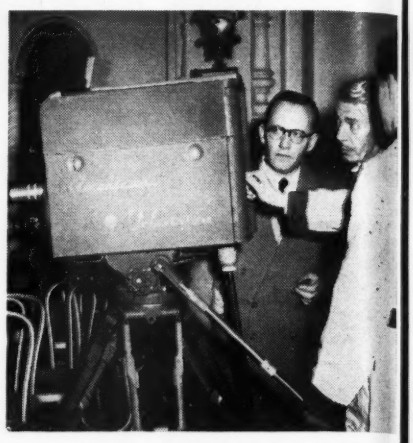
REFINERY SUPPLY COMPANY

Instruments - Laboratory Apparatus - Chemicals

Manufacturers of R. S. Specialties

621-23 East Fourth Street Tulsa 3, Oklahoma





Council Chairman Fred Utterbach of Chicago and R. W. Millard of Detroit take a bit of instruction in the intricacies of a TV camera.

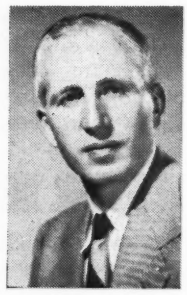
TV Lures 150 to Midwest Industrial Council Confab

Despite the best efforts of three top speakers, television stole the show when 150 industrial gasmen turned up in Gary, Ind., for the Midwest Industrial Gas Council's two-day meeting late in May.

With two cameras grinding away and six sets registering the proceedings, M. Goldstein of the American Television Institute, Chicago, took over the podium for a large share of the first afternoon to explain "The Past, Present, and Future of Television."

Other speakers included H. Pelphrey, Michigan Tool Co., on "Hot and Cold Treatment of High Speed Steel"; S. C. Parker, Peoples Gas, Chicago, on "Induction Melting vs. Gas Melting for Non-Ferrous Metals"; and G. E. Marble, Michigan Consolidated, Detroit, on "Steam Boilers as a Potential Market."

Setchell Wins Section Post



J. S. Setchell

J. Stanford Setchell, who has been an AGA staffman for 10 years, has been appointed assistant secretary of the association's operating section. Mr. Setchell has been assisting the section's secretary, A. Gordon King, since the first of the year.

Mr. Setchell joined the AGA utilization bureau in 1936, after graduation from Polytechnic Institute of Brooklyn with degrees of bachelor and master of mechanical engineering. In 1940, he was appointed assistant utilization engineer. He served in the U. S. Navy from 1943 to 1946, returning to AGA upon his discharge.

Heyn Choice of Furnace Men

Henry M. Heyn, sales manager of Surface Combustion Corp.'s heat treat division, was elected president of the Industrial Furnace Manufacturers Assn. in the association's annual meeting in Hot Springs, Va.

Humphrey ROYALINE
Circulator
Available in Three Sizes

Humphrey RADIANTFIRE
Circulator
Available in Three Sizes

EASY to sell because they fit every buying requirement of your customers! Modern, beautiful styling and duo-tone brown finish that enhances any room . . . unsurpassed in ability to produce fast, clean, sustained heat . . . initial low cost and economical operation . . . and built for years of dependable service. Humphrey gas burning circulating heaters can be controlled manually or automatically . . . available with safety controls . . . operate on all types of gases.

Write today for catalog and prices on Humphrey Radiantfire and Royaline circulating gas heaters.

A HUMPHREY PRODUCT

GENERAL GAS LIGHT COMPANY

KALAMAZOO, MICHIGAN

23 WARREN ST., NEW YORK CITY | 2nd UNIT SANTA FE BLDG., DALLAS | 225 ELEVENTH STREET, SAN FRANCISCO

SALES and PROMOTION

Range Shipments Up 69%; Water Heaters Set Record

For the first four months of 1950, industry shipments of domestic gas ranges were up a whopping 68.8% over the same period last year, GAMA statistics show. But electric range shipments continue high too.

The gas industry shipped 888,000 units as against 526,000 for the same period last year—and nearly double the average for pre-war years. Electric ranges shipped are estimated to total 413,900, up 23.4% over the first four months of 1949. The 166,000 electric ranges shipped in March was a record for number of shipments for a single month.

Meanwhile, the impetus of the Court of Flame scheme was reflected in record shipments of water heaters in April, which totaled 176,700, up 53.4% over last year's 115,200. For four months, shipments were 639,800, 62.3% better than 1949's 394,100.

Indianapolis Takes Three Better Copy Contest Prizes

Citizens Gas & Coke Utility, Indianapolis, walked off with three prizes in the annual "Better Copy Contest" of the Public Utilities Advertising Assn., which announced its awards following its annual convention in Kansas City last month.

Citizens Gas & Coke won second place in the competition for public relations newspaper advertising by gas utilities serving 125,000 customers; second place for outdoor advertising by gas and electric utilities; and third place for window displays by gas utilities serving 125,000.

Philadelphia Electric Co. came out on top in the judging of the best institutional advertisements, and received a second prize for its effort in the "best single ad by a gas company" category.

Consumers Power Co., Jackson, Mich., won the admen's top endorsement in the contest's window display division.

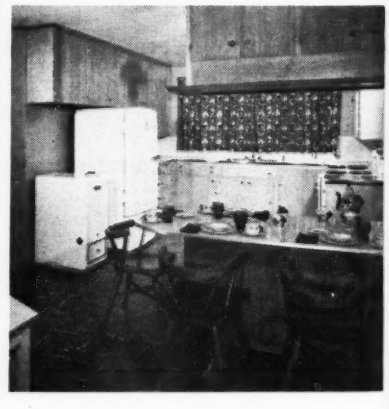
Best Demonstrations Named

Minneapolis Gas Co.'s home service director, Isabel McGovern, has been named top winner in the AGA Home Service Committee contest for the best demonstration of an automatic gas range built to CP standards. The CP manufacturers group of GAMA contributed 29 prizes totaling $500.

Miss McGovern received $100; second prize of $75 went to Margaret Bauer of Rochester (N.Y.) Gas & Electric; third prize of $50 to Lois Payne, Westchester Lighting Co., Mt. Vernon, N. Y.; and the $25 fourth prize to Lucille E. Boettcher, Laclede Gas Co., St. Louis. Twenty-five awards of $10 each were also presented.

GAMA to Choose King

The gas water heater salesman who sells the most automatic water heaters during this year's Court of Flame contest will be proclaimed king of the court and will be honored at a coronation ceremony to be held in Atlantic City during the annual AGA convention and GAMA exposition in October.

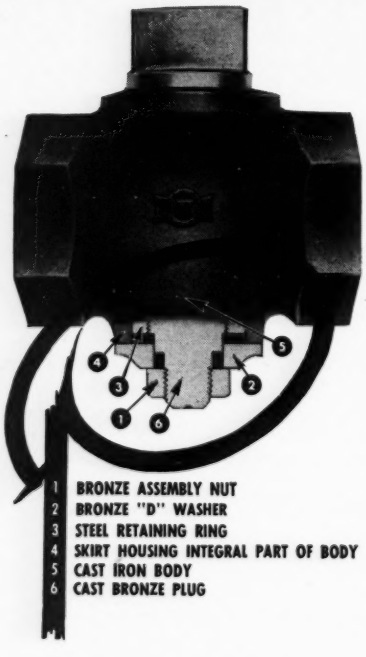


Gas does five jobs in this New Freedom all-gas kitchen which is part of the "Castles in the Air" luxury home exposition in California's Sherman Woods section, San Fernando Valley. Admissions to the four estate-class homes will benefit a new Shrine hospital for crippled children now under construction in Los Angeles. This kitchen is equipped with a Servel refrigerator, Western Holly range, Calcinator garbage disposal unit, General water heater, and Whirlpool clothes dryer.

HAYS®

TAMPER-PROOF GAS STOPS

FEATURES


1 BRONZE ASSEMBLY NUT
2 BRONZE "D" WASHER
3 STEEL RETAINING RING
4 SKIRT HOUSING INTEGRAL PART OF BODY
5 CAST IRON BODY
6 CAST BRONZE PLUG

- Tamper-Proof Design with Non-Removable Plug.
- Extra Grade Gray Iron Body, Gas Service Bronze Plug.
- Steel Retaining Ring Prevents Removal of Plug.
- Steel Retaining Ring Assembled to Bottom of Plug—Eliminates Possible Damage to Precision Ground Surface of Plug and Body.
- Steel Retaining Ring Threaded and Staked to the Largest Metal Diameter on Bottom of Tapered Plug—Assures Retention without Distortion.
- Steel Retaining Ring Anchored without Drill Hole or Pin—Eliminates Possible Shearing of Plug.
- Steel Retaining Ring Located below Shoulder of Body—Permits Freedom for Service Adjustment of Plug.
- Steel Retaining Ring Recessed and Inaccessible within Iron Body—Gripless and Shearless.
- Plug and Body Precision Ground and Matched for Perfect Seating.
- Individually Tested Under Rigidly Controlled Inspection.
- Lubricated with a Compound of Greases Suitable for Use with Manufactured, Natural or Liquid Petroleum Gases.
- Obtainable in a Variety of Patterns.

Write for Folder 120-C

AVAILABLE IN

Black or Galvanized

Flat Head Less Check
Flat Head With Check
Flat Head With Lock-Wing

Sizes; ¾"—1"—1¼"—1½"—2"

Also HAYS STANDARD
HEAVY PATTERN IRON BODY GAS STOP

For 75 Years the Gas Industry has relied on HAYS Iron Body Gas Stops

In addition to a jeweled crown, the winner will receive a three-day all-expense trip for two to the exposition and $500 worth of Fiberglas merchandise.

Top dealer salesmen in the 48 states and Hawaii will reign as knights of the Court of Flame, and each will receive $50 worth of Fiberglas prizes and an inscribed parchment.

Sales Slants

Distribution of Servel gas refrigerators and water heaters recently was placed under the Evansville, Ind., firm's factory sales branch in Chicago. All utilities and distributors in the Wisconsin area will be serviced by the Chicago branch, and dealer coverage there will be expanded. It was also announced that C. S. Johnston Jr., manager of Servel's Tennessee and Kentucky district, has been named assistant branch manager in charge of sales for Wisconsin.

A completely automatic model with "matchless ignition" has been added to the line of gas clothes dryers made by Hamilton Manufacturing Co., Two Rivers, Wis. The pilot light is ignited by a platinum glow coil. The company also announced a price reduction on its standard automatic gas model.

A $1.5 million contract for the installation of 18,186 dual floor furnaces in the Lakewood Village housing development in Los Angeles county was signed recently. Units of 45,000 and 57,000-Btu capacity are being installed. Manufacturer of the equipment is Johnston Gas Furnace Co., North Hollywood, Calif.

Equitable Gas Co., Pittsburgh, has contracted for exclusive rights in its area to "Handy Flame," a gas industry advertising figure. The character will appear in all advertising, on letterheads and bills, and wherever the utility's name appears.

EXPANSION

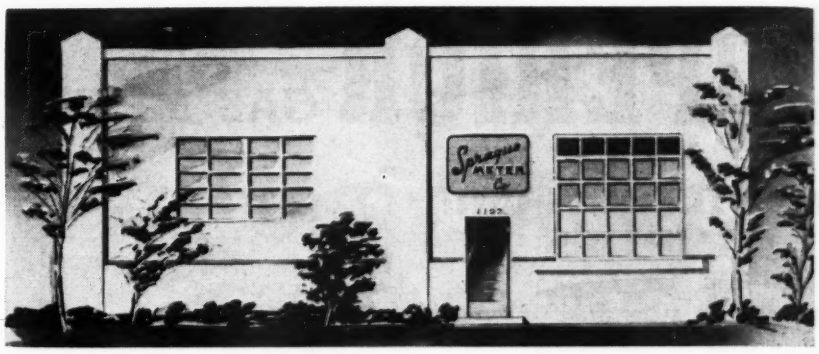
High-Pressure Holders Increase L.A. Lab Storage

New storage facilities for the manufactured gas used by the Pacific coast branch of the AGA Laboratories have been installed, the association announced this month.

The storage system at the Los Angeles lab, which formerly utilized a water seal holder, now has eight times the former capacity with its two new high-pressure vessels. The new installation provides adequate supplies for the laboratory's increasing test load and will improve the operation of the plant used to produce test-manufactured gas by reforming natural gas.

The low pressure holder formerly used made it necessary to maintain the reforming plant at a high operating temperature continuously—the new arrangement allows three weeks of operation without replenishment of the storage vessels.

The new system, including two high-pressure vessels, has a capacity of 65 Mcf of gas at 450 psig. Consideration for the addition

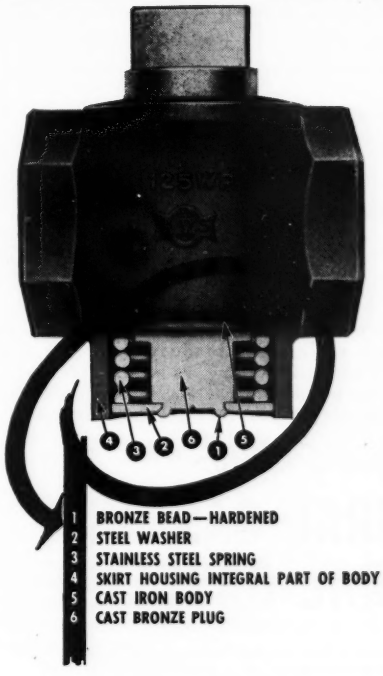


New Houston facility of Sprague Meter Co. of Bridgeport, Conn., housing repair and delivery services for the Southwest. A second, larger base has been set up at Davenport, Iowa, to serve the west north central section.

HAYS ®

TAMPER-PROOF GAS STOPS

FEATURES



1 BRONZE BEAD—HARDENED
2 STEEL WASHER
3 STAINLESS STEEL SPRING
4 SKIRT HOUSING INTEGRAL PART OF BODY
5 CAST IRON BODY
6 CAST BRONZE PLUG

- Positive Tamper-Proof and Vandal-Proof Design.
- Non-Removable Plug—with Constant Spring Tension for 125# Working Pressure.
- Extra Grade Gray Iron Body, Gas Service Bronze Plug.
- Tough Stainless Steel Spring—Strong Steel Washer, Retains Plug in Body.
- Heavy Bronze Bead, Hardened—Holds Steel Washer to Bottom of Plug.
- All Assembly Parts Recessed and Inaccessible within Iron Body—Gripless and Shearless.
- Precision Ground Plug and Body—Matched for Perfect Seating.
- Lubricated with a Compound of Greases—Suitable for Use with Manufactured, Natural or Liquid Petroleum Gases.
- Spring Tension Allows Free Turning and Reseating of Plug in Body.
- Individually Tested Under Rigidly Controlled Inspection.
- Flow Way Equal to Rated Capacity of Domestic Consumer Meters.
- Obtainable in a Variety of Patterns.

Write for Folder 120-C

AVAILABLE IN

Black or Galvanized

Flat Head Less Check
Flat Head With Check
Flat Head With Lock-Wing

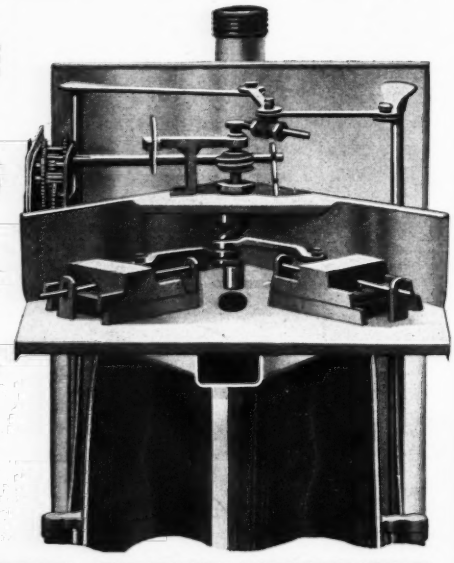
Sizes; ¾"—1"—1¼"—1½"—2"

Also HAYS STANDARD
HEAVY PATTERN IRON BODY
GAS STOP

For 75 Years the Gas Industry has relied on HAYS Iron Body Gas Stops

SUPERIOR GAS METERS

ALL THAT THE NAME IMPLIES



- ***Full Line***
From 150 to 7,500 cu. ft. per hour capacity. For domestic, commercial and industrial use.
- ***Time Tested Quality***
One piece, ribbed steel carriage. Heavy, non-fluttering valves. Flanged cases. Many other proved features.
- ***Fast Parts Service***
Interchangeable parts for "Superior" and other makes.
- ***Nationally Recognized***
Increasingly specified by America's leading gas utilities.

CATALOG UPON REQUEST

SPECIALISTS IN TIN STEEL METERS

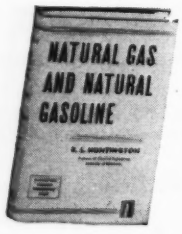
Meters • Meter Repairs • Diaphragms • Parts • Accessories

SUPERIOR METER CO., INC.

167 41st Street, Brooklyn 32, N. Y.

Latest methods in

The production and transportation of natural gas and gasoline



HERE is the up-to-date information you want on the production of natural gas from crude-oil, condensate, and dry-gas fields, and the manufacture of liquefied products from this raw material. The recovery of natural gasoline, as well as its transportation and storage, is discussed, and the design and operation of gas gathering and natural gas recovery systems are clearly treated.

Just Published!

NATURAL GAS AND NATURAL GASOLINE

By R. L. Huntington

Professor of Chemical Engineering, University of Oklahoma
THE McGRAW-HILL CHEMICAL ENGINEERING SERIES

598 pages, 6 x 9, $8.00

THIS book answers specific questions on the location and design of natural gas plants, the estimation of gas and gasoline reserves, and the construction and operation of pipelines. It takes up recent advances and developments in distillation and fractionation, gas dehydration, oil absorption, and other operations in the industry.

The case history method is used to illustrate special techniques and operations, and valuable petroleum data tables bring information which helps in effecting better design and more efficient operation in the various phases of natural gas and gasoline production and transportation.

Check this book for the latest advances in:

- **gas condensate cycling**
- **oil absorption**
- **fractionation**
- **gas dehydration**
- **pipe line design**

Write to Box 1000, GAS Magazine, 198 S. Alvarado St., Los Angeles 4, Calif.

of two pressure vessels should they be needed was included in the design of the installation.

Oahu Refinery Near Completion

Pacific Refiners Ltd., whose formation was announced by its parent, Honolulu (T.H.) Gas Co. late last year, is now delivering LP-Gas on the islands and will be under way by the end of the summer on the production of oil for gas manufacture.

Delivery of the butane in advance of completion of the plant was made possible by an initial shipment from the mainland of 25,000 gals. in the 1100- and 500-gal. tanks which are to be installed in the distribution system. LP-Gas, as well as asphalt, will be produced with the oil in the refinery.

Footnotes on Expansion

An $85 million loan, described by President D. A. Hulcy as "probably the largest single financial transaction ever closed in Texas," was concluded June 9 by Lone Star Gas Co., Dallas, with 12 leading finance houses participating. Of the amount, $55 million was used to retire outstanding loans, $29 million will be used to help finance a five-year, $81 million expansion program.

Binghamton (N.Y.) Gas Works has announced that it will spend $132,000 this year to improve gas pressure in Binghamton and Johnson City. About 21,000 ft of new gas mains and new regulatory equipment are included in the program.

MANUFACTURERS

Dresser Moves to Dallas To Get Closer to Market

Dresser Industries Inc. moved its headquarters to Dallas last month.

The parent company of 11 operating units producing equipment for the oil and gas industries, Dresser made the move to be closer to the source of most of its sales—the rich oil and gas properties of Texas. Formerly, Dresser Industries Inc. had its offices in Cleveland. In Dallas, the company occupies the entire third floor of Dallas' new Atlantic building.

One Dresser subsidiary, International Derrick & Equipment Co., has shifted its main headquarters (which were already in Dallas) to the third floor of the Atlantic building.

Included among subsidiaries serving the gas industry are Clark Bros. Co. Inc., Olean, N. Y.; Dresser Manufacturing Division, Bradford, Pa.; Dresser Manufacturing Co. Ltd., Toronto; Roots-Connersville Blower Corp., Connersville, Ind.; Security Engineering Co. Inc., Whittier, Calif., and The Stacey Bros. Gas Construction Co., Cincinnati.

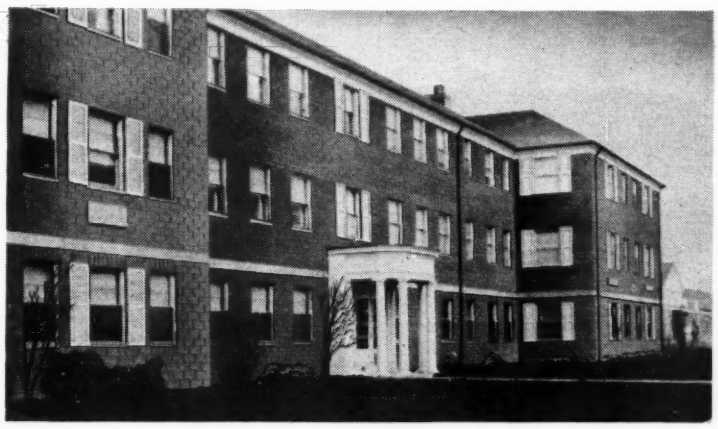
Newsnotes

Vulcan Proofing Co., Brooklyn, has changed its name in order to make its products more easily identifiable by corporate name. Henceforward, it will be known as Vulcan Rubber Products Inc.

APARTMENT & F. H. A. PROJECT BUILDERS REDUCE CONSTRUCTION COSTS WITH INDIVIDUALIZED GAS HEATING

MIDGET HYDROTHERM HEATING PLANT SERVES LARGE GARDEN APARTMENTS

ENGINEERED TO SUPPLY HOT WATER HEAT FOR 3-5 ROOM APARTMENTS AT MINIMUM COST



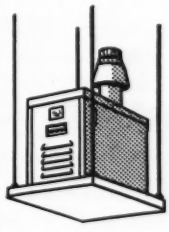
A single pipe carries gas for cooking and heating into each of the 350 suites of the basement-less Mayflower Garden Apartments, Cleveland, Ohio. In each apartment a Midget HYDROTHERM converts the gas into hot water heat —silently, efficiently and to the exact comfort standard of the individual tenant. Specially engineered for this purpose, the Midget HYDROTHERM does its job well. It occupies no floor space since its compactness makes it possible to suspend it from the ceiling or place it on a shelf. Though fully automatic it requires no electrical connections and is available at surprisingly low cost. HYDROTHERM features now make it possible to install individualized heat in apartment buildings at less cost than central heating plants which require extensive steam fitting, costly basements and continued maintenance.

FACTS ABOUT HYDROTHERM MODEL 2HW2

(U. S. Patent 2,247,796)

Rating: 45,000 BTU Input—180 sq. ft. Installed Radiation. AGA Approved for all Gases, incl. L.P. Gas.

Applications: Radiant, Convector and Baseboard Heating systems of 3 to 6 room apartments and small homes.



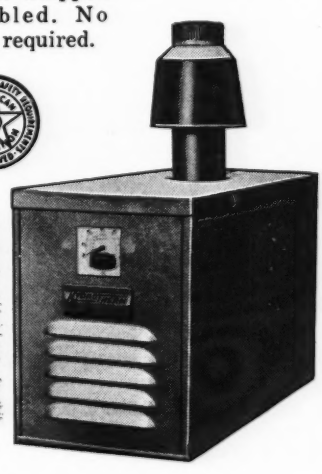
Suspended installation

Size: 13″ wide x 26″ deep x 17″ high. Weight 160 lbs. Suspends from ceiling or sets conveniently on shelf.

Operation: Fully automatic — Safe — Dependable — Long-life, cast iron heat exchanger of patented design assures maximum efficiency — 100 lbs. ASME rating.

Shelf installation

Cost: Costs Less to Buy — Less to Install — Less to Operate. Shipped assembled. No wiring required.



HYDROTHERM MODEL 2HW2

The Midget Automatic Gas Heating System

HOOK & ACKERMAN, Inc.

18 East 41st Street
New York 17, N. Y.

Write today for Bulletin 2H

SULFUR-FREE GAS

AT LOWEST COST

WITH IRON SPONGE

Iron Sponge is a concentrated purification material that operates with high efficiency at high or low pressures, has excellent capacity and activity, gives long service between foulings and is simply and quickly regenerated. This is why Iron Sponge has been preferred for H_2S removal for over 75 years.

CONNELLY Inc.

3154 S. California Ave., Chicago 8, Ill.
Elizabeth, N. J. • Los Angeles, Calif.

NEW!

PATHFINDER PIPE LOCATOR

NOW TRADE-IN YOUR OLD PIPE LOCATOR

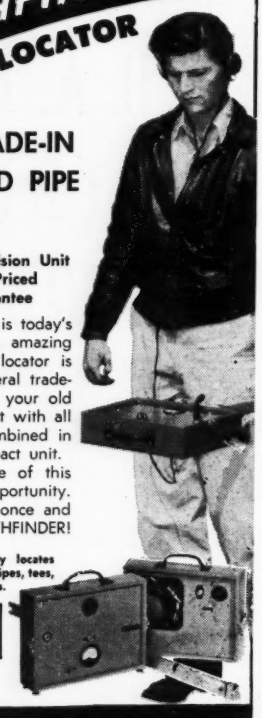
★ Powerful Precision Unit
★ Economically Priced
★ Lifetime Guarantee

PATHFINDER is today's BEST BUY! This amazing new 1950 pipe locator is FIRST with a liberal trade-in allowance for your old equipment — first with all vital features combined in one handy, compact unit.

Take advantage of this money-saving opportunity. Get the facts at once and you'll buy a PATHFINDER!

Quickly and accurately locates position and depth of pipes, tees, valves and buried tools.

Write! State model and year of locator to be traded.



PATHFINDER COMPANY
1726 Beverly Drive • Pasadena 7, California

Peerless GAS CIRCULATORS

Radiant and plain front fully vented models.

20,000 to 60,000 B.T.U. sizes.

Manual or Automatic Controls.

NEW Silver-Tan finish.

NEW Seam Welded gas tight heating sections.

A. G. A. Approved.

Write NOW for complete NEW literature on the line that sells.

Forced air and gravity, Gas Circulators — Unit Heaters — Panel Heaters — Wall Heaters — Radiant Heaters.

PEERLESS MANUFACTURING CORP, LOUISVILLE 10, KY.

A new westcoast warehouse will be opened Aug. 1 by Dresser Manufacturing Division of Bradford, Pa. Located at 103 South Bayshore highway, San Francisco, the facility will service the coastal states plus Idaho, Nevada, Utah, and Arizona. Paul McCullough has been named warehouse manager, serving under District Manager R. J. Driggs.

General Electric has announced the formation of a new company, Central Heating Distributors Inc., to handle distribution of GE gas house-heating equipment in the northern New Jersey market. The new firm will sell gas-fired boilers and warm-air furnaces from its headquarters in Maplewood, N. J.

FINANCIAL

Gas Utility Rates Are Having Their Ups & Downs

June brought a summer season upswing in the volume of utility attention to rate structures. Some new requests for increases were submitted, some were denied, and some companies (particularly in eastern areas that are just starting to get natural gas) asked that their rates be lowered.

Jersey Central Power & Light Co. had its customers all in smiles, as its reduced rate schedule got a beaming okay from the state public utilities commission. The company estimated that 60,000 users in the Jersey shore section would benefit from a $150,000 annual saving—instead of the increase that Jersey Central would have had to request had its share of natural not been forthcoming this year.

Peoples Gas Light & Coke Co. is awaiting decision on its request for a 30% increase in rates for interruptible and off-peak customers, of which it has about 550.

City of Danville, Va., anticipated the coming of natural too, with adoption of a new rate schedule that figures to lop from 28 to 50% off customers' bills when natural gas reaches the city late this year.

Southern Counties Gas Co. will add about 70 cents per month to the average customer's bill if the okay for a requested general rate increase is granted by California Public Utilities Commission.

Southern Counties was also involved in FPC hearings in Los Angeles. The company is receiving Texas gas through the Texas-California line, transporting it south from Moreno, Calif., and selling it for resale to San Diego Gas & Electric Co. FPC engineers differ with SoCounties engineers by $200,000 annually in their estimates of the costs connected with this transaction.

Pacific Gas & Electric Co. has told the California Public Utilities Commission that it needs $15.6 million in revenues from central and northern California customers to come out even in the job of bringing Texas gas to the San Francisco bay area.

Washington Gas Light Co., together with the District of Columbia Public Utilities Commission, was getting ready to appeal the decision of U. S. District Judge T. Alan Goldsborough setting aside a $750,000 rate increase okayed for the company by the commission.

Financial Footnotes

Operating revenues of natural gas companies totaled $120,916,694 for the month of March, up 25.7% over the figure for the same month in 1948, according to FPC announcement. Gas utility operating income for March was $24.7 million, a rise of 23.7% over a year ago, and net income went up from $16.9 million in March 1949 to $21.5 million for the same month this year. Gas sales for the same month in 1950 were 171,159,000,000 cu ft, 17.7% greater than in March a year ago.

The Wisconsin Public Service Commission has turned down the proposal of Milwaukee Gas Light Co. to pay $298,765 to its subsidiary, Milwaukee Solvay Coke Co., for standby gas service. The commission pointed out that the amount was almost equal to the cost of running the standby facilities on a fulltime basis, and took a dim view of what it said was a clause in Milwaukee Gas Light's plan to provide standby facilities for its standby facilities.

Wisconsin Electric Power Co. has carried through its plan to buy all of the electric utility properties of its subsidiary, Wisconsin Gas & Electric Co. The parent company will operate the facilities, while the subsidiary engages in the distribution of gas under the name Wisconsin Natural Gas Co.

Perth Amboy Gas Light Co. also disappeared from the fuels scene last month. It was merged with Elizabethtown Gas Co., Elizabeth, N. J. and henceforward will operate as a division of Elizabethtown Gas.

Cecil A. Runyon of Albion, Mich., has purchased (for $2.1 million) the manufactured gas facilities of Detroit Edison Co. Subject to approval, Southeastern Michigan Gas Co., of which Runyon is president, will build a 65-mile pipeline between the newly purchased plant and a connection with the Panhandle Eastern natural gas line and will begin serving natural gas to the 12,500 customers in St. Clair and Macomb counties, Michigan, on Oct. 31.

MISCELLANEOUS

Consolidated Fund Raising Plan Effected at Dresser

A plan that will end the many fund drives of the social agencies within a company each year—and at the same time insure greater employee participation in such drives—has been instituted in the Bradford, Pa., plant of Dresser Manufacturing Division.

Conceived by the company's personnel department, the plan included formation of the Dresser Service League, members of which agree to voluntary payroll deductions to be distributed among Bradford's social agencies —Community Chest (which in turn uses the revenue for its 11 separate programs), American Red Cross, American Cancer Society, Crippled Children's Society, and the March of Dimes.

The Dresser Service League is administered by a three-man board of directors,

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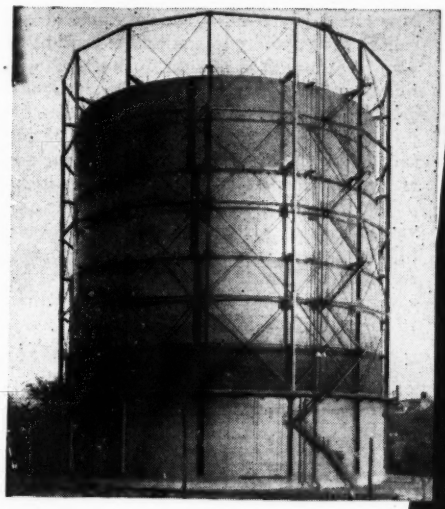

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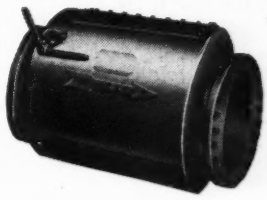

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members of which are chosen to represent management, office staff, and factory staff. Employees who join the league are given membership cards and a large window placard showing their contributions to the various programs.

San Diego Scores With Booklet For Customers

A heads-up job of public relations for San Diego Gas & Electric Co. has just been completed with the publication of "Services and Residential Rates," a handsome two-color booklet telling the why and how of company operation.

In the 20-page, illustrated brochure, SDG&E customers can find the answers to almost any questions they could dream up about their utility's service. Explanation of how rates are arrived at for the different localities served and why gas and electric bills vary from month to month, listing of phone numbers and addresses of branch offices, advice on the procedure to follow in case of power or appliance failure, description of the sources of the company's power and fuel—all are included in well-written summaries.

The booklet invites customers to take advantage of the free advisory service that SDG&E offers, cautions housewives to ask for identification of anyone purporting to be a gasco serviceman. Even graphic instruction in meter-reading is presented.

And with all the factual material in "Services and Residential Rates," space has been found to include subtle reminders that the company is really a trustworthy servant.

Gas Safety Record Improves

While still far down the list among industries reporting, gas utilities showed an improved industrial safety record in 1949, the National Safety Council reports.

In line with industry in general, gas companies hammered down accidents both in numbers and in severity. In frequency-per-million-man-hours, the gas record of 17.92 represented an 11% betterment of 1949's score, while all industries averaged 12%. Yet gas utilities rank 33rd among 40 industries. The industry average is 10.14%.

In severity, gas stuck close to the 1.02 median with a .99 per-thousand-man-hours record, improving 11% as compared with the industries, 9%. Its ranking stood at 22nd.

$500 for Coke Moving Idea

Walter W. Cain, general foreman of gas production at the Hunts Point plant of Consolidated Edison Co. of New York Inc., is $500 richer this month as the result of his prize-winning contribution to ConEd's employee suggestion plan. Mr. Cain won his award for the design of a central control panel board for regulating coke conveyor systems at Hunts Point.

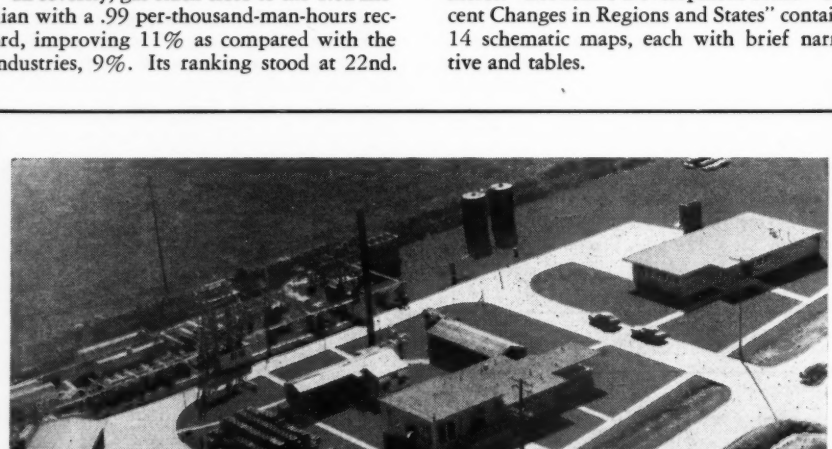
Before adoption of Mr. Cain's panel design, ConEd employees had to start and stop the series of coke conveyors, grizzles, and screens from widely separated locations.

Miscellany

In the next 30 years, the average U. S. employee's real hourly wages will double, if production per man-hour continues to rise at its past rate. This was the recently released find of the research and policy committee of the Committee for Economic Development.

The National Safety Council has issued a new "safetygraph," a portfolio of safety lessons designed as a visual aid in the education of workers against the hazards of falls. One out of four fatal industrial accidents, according to the council, is caused by falls.

Graphic presentations of the economic shifts that have occurred throughout the U. S. in recent years are available now in a new booklet published by the Office of Domestic Commerce of the U. S. Department of Commerce. "Economic Development Atlas—Recent Changes in Regions and States" contains 14 schematic maps, each with brief narrative and tables.



Natural Gas Odorizing Co. Inc., Houston, recently moved into its new offices at the company's Wallisville road site. The buildings occupy 4800 sq ft, including a new executive and administration building and a plant and laboratory building.

Modern facilities for every operation have been included in the design of the new headquarters. Each building has a complete kitchen, the advertising office has an adjoining photographic darkroom setup, and there are shower and dressing rooms and a cafeteria.

Natural Gas Odorizing plans the addition of a large warehouse, which will complete the integrated plant layout. The company presently maintains stock warehouses in Joliet, Ill., and Philadelphia.

GAS CLASSIFIED

Classified advertising is set in 6-point type, without border or display, at the rate of 15 cents per word per insertion; minimum charge per insertion $3. Box numbers for replies count as 5 words. Count as a word each one letter word and each group of figures. Classified advertising is only accepted when payment accompanies order. Copy and payment must reach publisher's office prior to 10th of month preceding publication.

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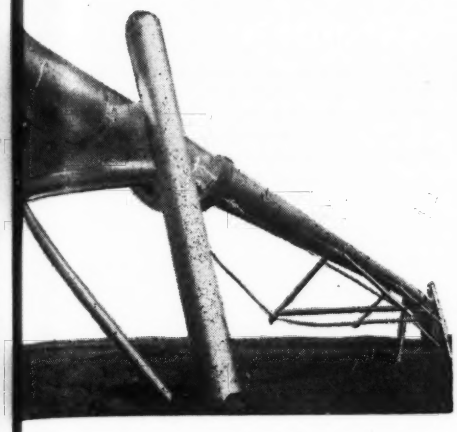


An Efficient Method of Crossing Small Rivers and Creeks

By M. J. PETERSON

OKLAHOMA Natural Gas Co., Tulsa, believes that it has found a satisfactory solution to the problem of economically and easily building a stable and efficient pipeline crossing over a canyon, creek, or small river.

Exclusive

It is expensive to cut down the banks of a deep canyon or waterway sufficiently to place the pipeline below the bed. The latter operation is quite difficult in the presence of even a small amount of water. Too, when exposed to water current with floating debris, even good coating may be damaged, allowing the pipe to corrode in the alternating presences of air and salty or stagnant water. Further, the banks must be replaced in a stable condition, and maintained so, to protect line approaches from eddy currents which would undercut and leave the line strained by suspension in mid-air. Pipe maintenance and the repair of such crossings are not only expensive but temporary. Generally each must be renewed one or more times during the normal life of the pipeline proper.

Deep canyons and creeks can be crossed, without greatly disturbing the banks, by spanning straight across at pipeline depth if the intervening distance is short enough so that the pipe may support itself safely. However, recession of the supporting banks by erosion sometimes dangerously increases the span. Coatings are removed by the action of the elements, high-water current, debris, and floating trees. Alternate exposure to water and air then promotes corrosion, particularly at the banks.

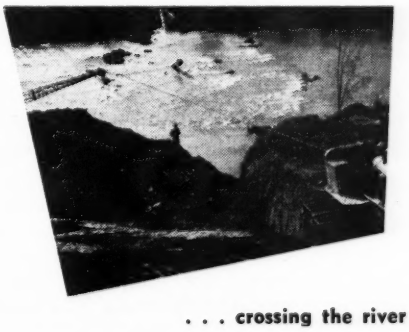
Experience indicates that "going under" certain types of waterways with a major gas transmission line may be a bad risk; conversely, that a suitable means of carrying the line overhead frequently is a good investment resulting in decreased maintenance and in assurance of uninterrupted delivery of gas to those thousands of customers who depend entirely on it for house heating, cooking and industrial use the year around.

Suspension of the pipe from catenary cables has proven satisfactory if properly done but is generally expensive and therefore economically applicable only to relatively wide rivers. High support towers on sound foundations must be erected and deep and stable anchors installed. Approximately five times as much main cable as the span length is required. Rigging of pipe slings and installation of the pipe is difficult and dangerous since much of it must be done in mid-air over water. Easements are often expensive or difficult to acquire because the spaces required for anchor cables and anchors extend away from the towers approximately half the span length—often into cultivated fields.

Oklahoma Natural Gas Co. has further developed a trussed overhead crossing for relatively narrow streams and canyons which is substantial yet simple, economical and easy to build.

It has been found to be a satisfactory substitute for all suspended crossings, except those of unusually long span, and for practically all short waterway crossings, many of which should properly be overheads but, because of high initial cost, might not be so installed. The company now has in service about 50 such trussed crossings, ranging in span lengths from 50 to 250 ft and in pipe size from 4 to 16 in.

Doubtless the most advantageous feature of the trussed crossing is that it is assembled on any suitable spot of ground near either bank, where it is readily accessible for assembly of its prefabricated components.



. . . crossing the river

Structurally the pipeline itself serves as the upper chord or main compression member of the truss. The lower chord or main tension member (or members) consists of two cables, each of which (the truss being viewed in vertical cross-section) forms an extremity of the base of a triangle whose 90° apex is the pipeline and whose 45° sloping sides are equal.

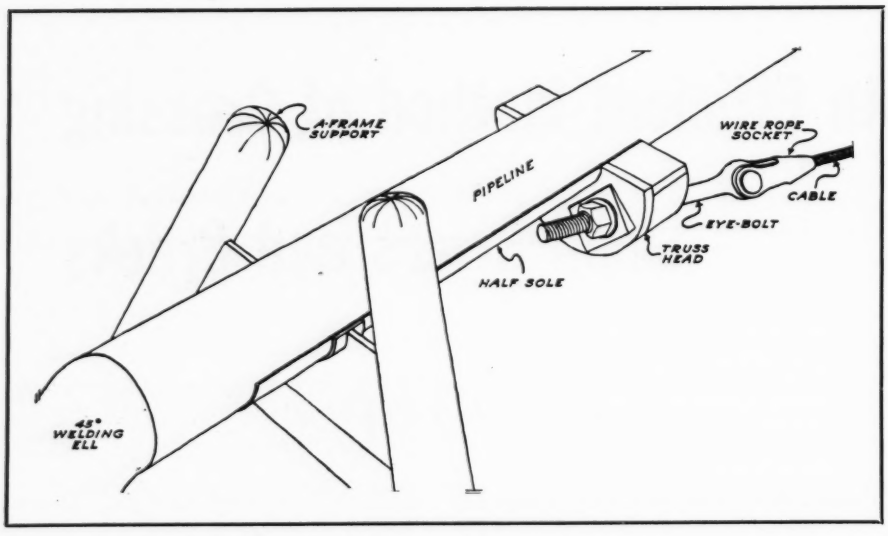
The truss thus formed is practically a rigid structure, when properly designed and installed. The use of two cables, positioned as they are, provides not only for carrying the dead load of pipe and rigging, but for resisting the horizontal force developed by a very strong side wind. It has been found that a design which allows for the temporary additional dead load caused by the weight of water for hydrostatic testing of the pipe is amply sufficient for wind load on the empty pipe at the same safety factor of three as is used.

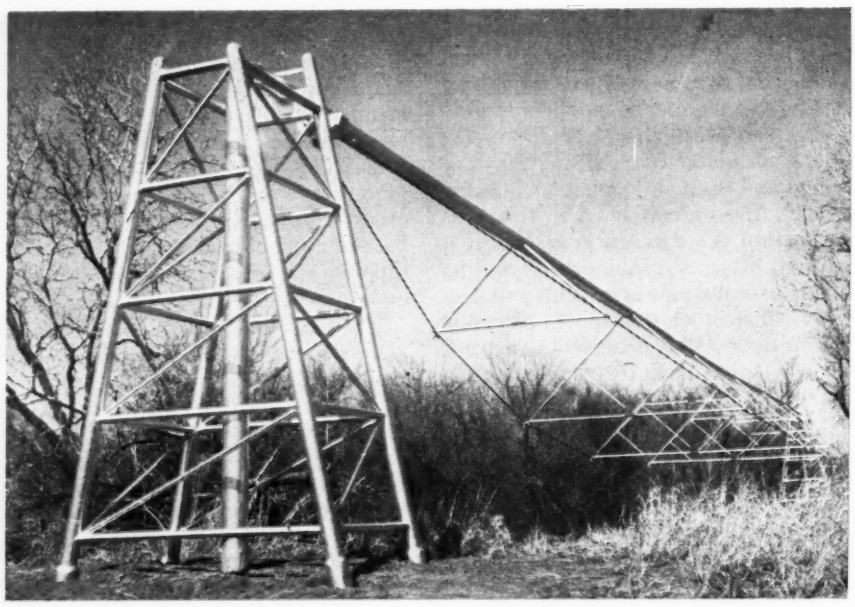
Oklahoma Natural Gas Co. has standardized the mechanical design and has set up a file of drawings which vary only with pipe size and length of span, the variation being principally in triangular strut frame dimensions and in cable size.

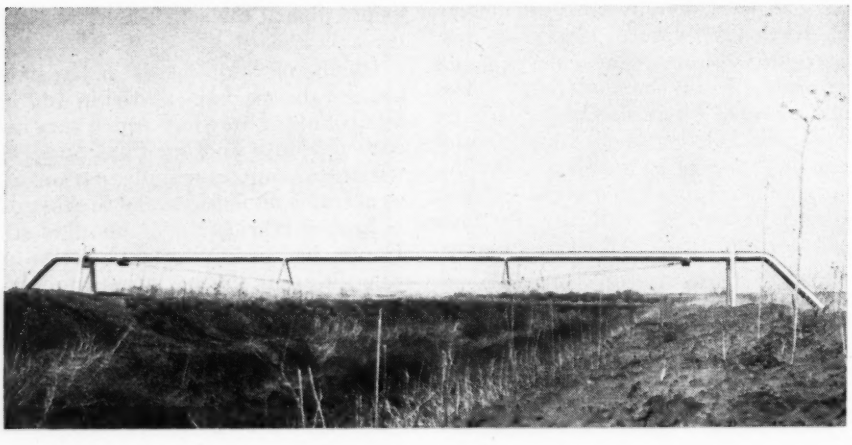
Proper fabrication of the pipe strut frames has been simplified by the use of positioning jigs in the machine shop. The truss "heads," or end cable connection assemblies, are also built in the machine shop. When several trusses are required, such as in the construction of a long pipeline, the heads are made on an assembly-line basis. Each consists mainly of a "half-sole" of pipe and a heavy semi-circular plate through which the cable eyebolts pass. The half-sole extends from over the span support past the semi-circular plate where the latter is stiffened and braced by gusset plates, some partially cylindrical.

The semi-circular plate, containing the eyebolt holes, is so placed that the center lines of cables, sockets and eye-

Mr. Peterson is an engineer on the staff of Oklahoma Natural Gas Co.







TOP: Closeup of cable connections of truss ends. CENTER: Washita river trussed pipe crossing; 10-in. pipe, 210-ft truss, four-legged supports. BOTTOM: Drainage channel crossing; 12-in. pipe, 90-ft truss, A-frame supports.

bolts, if extended, would meet on the center line of the span pipe over the support. The eyebolt holes are drilled on the 45° radial lines. On the support side of the plate rectangular plate washers are welded, wedge-shaped so that the eyebolt nuts will have bearing surfaces normal to the bolts.

Pin-and-clevis sockets are used to connect the cables to the eyebolts and are poured with zinc. Galvanized 7 x 7 wire-center bridge cable is preferred to hemp-center multi-wire rope because the former is both less elastic and more suited to a stronger socket pouring job.

It can be seen that no precise layout work or unusual workmanship is necessary in assembling the truss. The heads and strut frames having been shop-fabricated and delivered by truck, it is possible for two welders and helpers to assemble the largest truss in one day. The span pipe is placed straight and level on dollies or skids and the heads and frames are spotted, plumbed and welded onto the pipe in an upside down position. The cable is threaded and cut, the sockets are poured and the eyebolts are placed and tightened. The truss is then ready to be turned upright and carried into place.

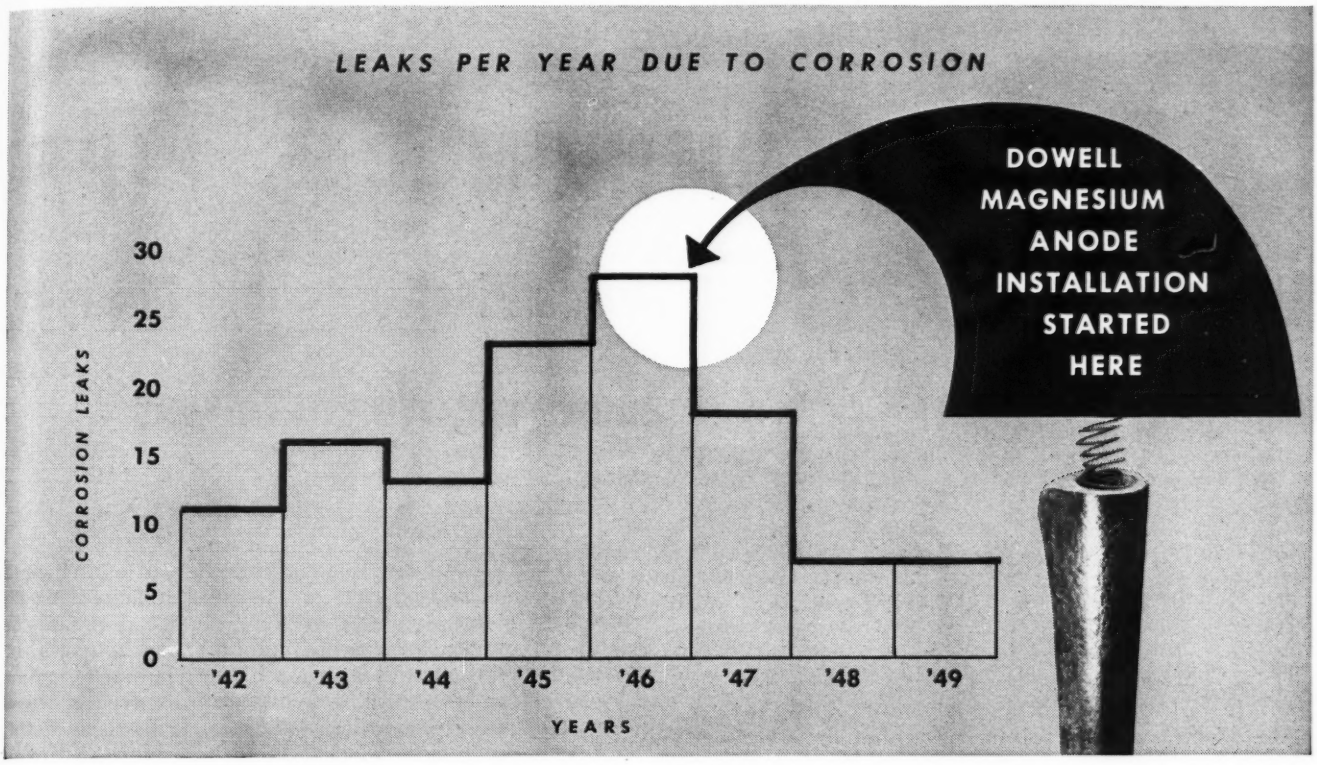
It is then carried to the nearest bank by two gin-pole trucks or side-boom tractors, pulled across the waterway by a winch line from one of them and lifted onto the permanent supports by boom or gin-pole or by a winch line through a snatch block at the top of each support tower. Sufficient tightening of the cable eyebolts at each end of the truss is then done to cause a slight upward camber of the pipe. The installation is complete after tying-in of the approach risers to the span and to the pipeline.

At debris-carrying streams, which go out of their banks, 90° pipe risers and welding ells protected within 4-legged cribbed support towers are employed. Otherwise 45° risers and 2-legged A-frame supports are used. The truss is so placed that the strut frames will be above floating trees borne by high water. It rests on the support in a saddle of plate shaped to the curvature of the pipe half-sole.

It is well, previous to tying-in the pipe risers, to install suitable anchors on the pipeline near the bottom ells. Any longitudinal movement afterward will induce a couple in the riser that may upset the intrinsic balance of the truss and, while generally not serious, may cause the span pipe to assume an unsightly wave shape. The close proximity of an unstrapped Dresser coupling in the pipeline obviates the necessity for proper anchorage because, without it, much more serious damage may result.

All parts of the installed truss are reasonably accessible for the occasional painting which, after proper initial cable adjustment, is all the maintenance required.

The writer wishes to express his gratitude to Miss Ruth Canaday of Oklahoma Natural Gas Co. for the use of the accompanying photographs.



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The reduction in leak rate graphed above was obtained on one section of 1000 miles of old bare pipe line after installation of a Dowell magnesium anode cathodic protection system. A 72% reduction in corrosion leaks and 60% reduction in oil losses were recorded. The results on this section were felt to be representative of the entire line.

The program, begun in 1947, called for the installation of approximately 7000 Galvo-Paks®, Dowell's packaged magnesium anodes, at all known "hot spots" and at the site of all new leaks as they appeared along the whole 1000 miles. Pipe line company officials estimated that the reduction in repair costs alone in the first 12 months after completion paid 85% of the total cost of installation.

While this is one of the largest cathodic protection programs yet undertaken, the results are not unusual. Sizable reductions in corrosion leaks are common when a properly designed system of Dowell magnesium anodes is installed. The degree of protection obtained will vary with the soil conditions encountered and the number of anodes installed.

Dowell magnesium anodes offer you effective, maintenance-free protection against corrosion. They are easily and economically installed and require no external power. Write to Tulsa for more complete information.

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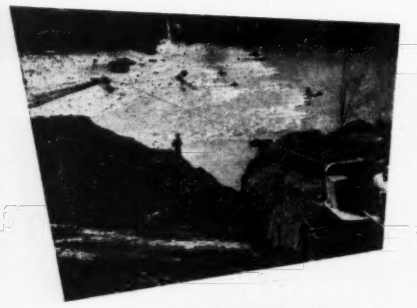

. . . crossing the rivers

ALUMINUM GAS PIPE

Makes River Crossings Cheaper, Allows Big Weight Saving

By W. B. MOORE

THE first use of large diameter aluminum pipe in connection with natural gas pipelines was made by a large oil company in a North Canadian river crossing near Bowie, Okla., recently. In this crossing, which was in a 10¾-in. OD by 3/16-in. gathering line carrying sweet gas at pressures up to 250 psi, 63S-T5 extruded aluminum pipe was used. This pipe was furnished in 30-ft lengths with the ends beveled at 30° for welding. This was an all-welded line, oxyacetylene being used because of unavailability of portable Heliarc equipment.

Exclusive

The total span from pier to pier was 318 ft. The aluminum line was welded on a wooden scaffold by pier No. 1 and as each new length of aluminum pipe was welded in place, it was then pushed ahead 30 ft onto the cable suspension system so that a new length of pipe could be placed in position on the scaffold and welded to the end of the string.

Single Cable Support

The entire system of pipe was supported from a 1¼-in. diameter steel cable hanging in catenary from pier to pier. Along the length of this main cable, ¼-in. cable slings were located at 30-ft intervals. These slings were of somewhat unusual construction, designed to facilitate the movement of the pipeline across the river. Two ¼-in. cables were connected to the opposite ends of a short steel rod on which a grease-packed, heavy neoprene hose was mounted to form a roller. The opposite ends of the ¼-in. cables were attached to a turnbuckle suspended from the main cable so that vertical adjustment was possible to level the line pipe after it had been brought to the final location across the river.

A 61S-T6 aluminum 150-lb drilling flange supplied by the Ladish Co. of Cudahy, Wis., was welded to each end of the aluminum string to permit flanging it to the main steel line on either side of the river. These aluminum flanges were insulated from the steel flanges with phenolic impregnated gaskets. So as to minimize the possibility of galvanic attack between the two metals, small Micarta tubes and gaskets also insulated the steel bolts of the flanges from the aluminum flanges.

The main features of this type of pipeline installation are:

Three times the capacity in gas can be carried by the same weight of pipe in aluminum or the same capacity may be carried by a line weighing one-third that of steel (this is highly important in aerial crossings of this type in that labor required for installation is so much less); a much smaller suspension can be used; it is important for the type of crossings which are placed over commercial bridges since the weight of a large diameter pipeline is tremendous and most bridges will not safely carry these extra loads; with the use of aluminum in these installations, no painting or other type of maintenance is required.

This particular crossing was installed at a cost considerably below costs for similar crossings using steel pipe.

SINGLE CABLE is sufficient support for aluminum gas pipe river crossing. Roller type cable supports are located at 30 ft intervals, have turnbuckle adjustments. Same capacity of a steel pipe at one-third the weight is possible with aluminum pipe.

Mr. Moore is a member of the technical service department, Reynolds Metals Co., Louisville, Ky.

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These tests cover every stage of production — from the mining of ore right through to completed pipe. The result is steel pipe which measures up to the exacting specifications of the gas, oil and water industries.

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KAISER STEEL PIPE SPECIFICATIONS • All pipe manufactured to latest A.S.T.M. and A.P.I. specifications

Type	Diameter	Length	Wall Thickness	Shipping Point
Continuous Weld—Threaded and Coupled	½" to 4" nominal I.D.	Uniform 21'	Standard	Fontana, Calif.
Continuous Weld—Plain End	2⅜" to 4½" O.D.	Up to 40'	Standard	Fontana, Calif.
Electric Resistance and Fusion Weld—Plain End	8⅝" to 22" O.D.	Up to 40'	.188" to .500"	Napa, Calif.—Basalt-Kaiser
Electric Resistance Weld—Plain End	5⅝" to 12¾" O.D.	Up to 55'	.188" to .400"	Fontana, Calif.
Electric Fusion Weld—Expanded—Plain End	24" to 30" O.D.	Up to 40'	.188" to .500"	Napa, Calif.—Basalt-Kaiser

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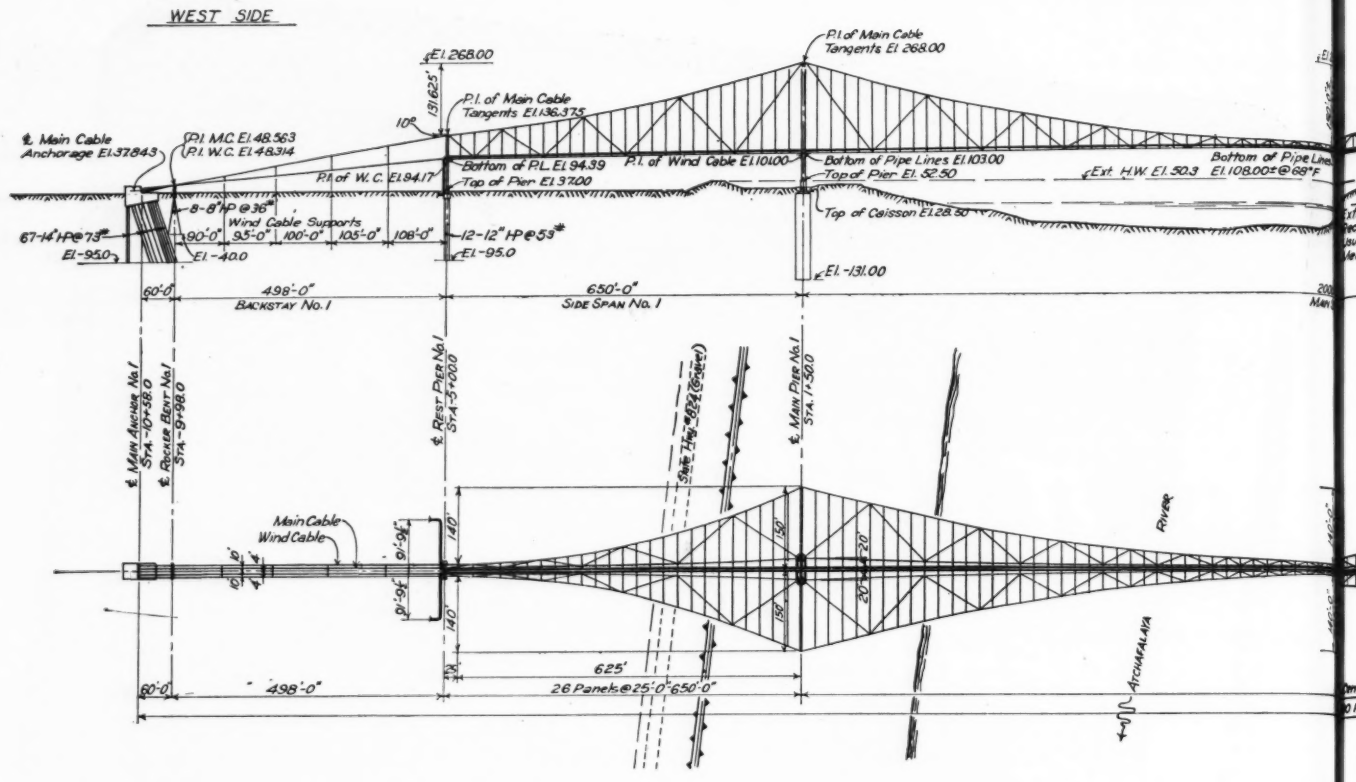


Transcontinental Crosses 40 Rivers

Texas-New York line projects include the longest pipeline suspension bridge ever attempted and the first submarine crossing of the Hudson

By Edward Titus

THE longest pipeline suspension bridge so far attempted and the first crossing of the Hudson with a large natural gas pipeline are included in the 40 major river crossings engineered for Transcontinental Gas Pipe Line Corp.

Exclusive

The line starts at a point near the Rio Grande, in Texas, and will extend across the Hudson to supply the big utilities of New York city and vicinity. The purchasers will include Consolidated Edison, Brooklyn Union, Long Island Lighting, and others.

Details of the river crossings were explained in an interview with Frank H. Chilson, chief engineer of Fish Constructors Inc., Houston, Texas, who is in general charge of planning the line.

The longest bridge is the one over the swift and treacherous Atchafalaya river in Louisiana.

The Hudson, on the other hand, is being crossed by a line deep in the river bottom, far enough down in the muck to be secure from such dangers as dragging anchors of ships.

Hudson Crossing

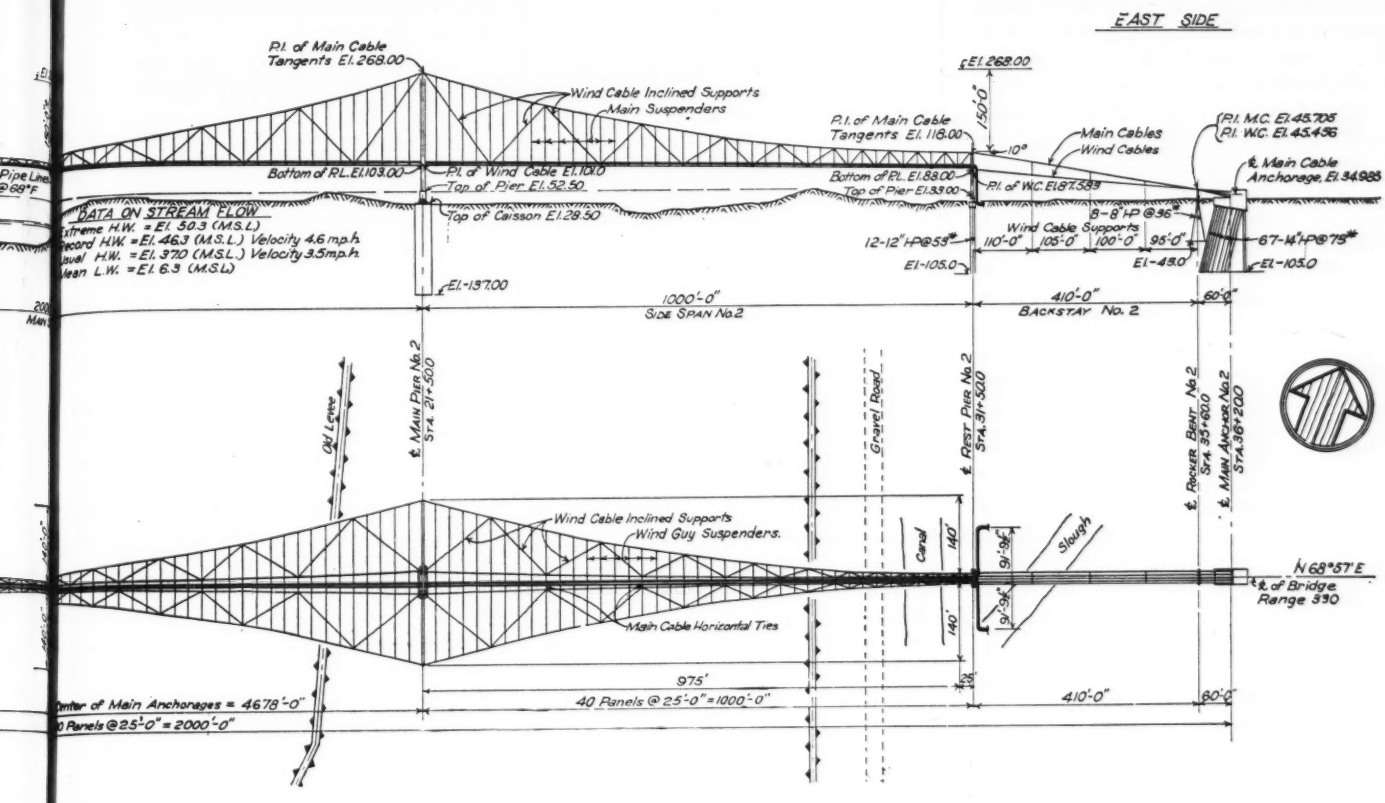
It was found that the river mud where the pipeline will cross consists of fine organic silt. The silt is of uniform characteristics down at least 100 ft (at this depth corings were taken). It was learned that the silt had practically no cohesion or internal friction when wet. Core samples indicated, however, that there is a considerable amount of consolidation, starting at 10 ft below the river bottom and increasing as depth increases.

The engineers had hydrographs made of the river bottom, and ran a bottom profile. Soundings and core samples were taken at 50-ft intervals. Engineers also consulted authorities who had gained experience with the vehicular tunnels under the Hudson.

After investigation of the probable depth to which ships' anchors might penetrate into the river's bottom, it was decided the minimum depth at which the river crossing pipe would have to be installed would be 25 ft below the bottom of the river, to be completely secure.

The Hudson crossing will be about a mile long. It will stretch from the New Jersey shore to a point close to 134th street, Manhattan. Water at the crossing location averages 40 ft in depth.

The problem of how to lay the pipe



ATCHAFALAYA RIVER CROSSING, in Louisiana, will be the longest pipeline suspension bridge crossing ever attempted (see schematic diagram above). Its overall length is 3650 ft, over water 50 ft deep. Government hydrographs showed such severe scouring on river's bottom that submarine crossing was ruled out.

25 ft under the river bottom was studied and it was sought to learn whether the line would tend to either float up or slowly settle in the mud.

It was decided the pipe should have sufficient negative buoyancy to maintain a uniform downward thrust of at least 5 lb per linear foot when installed at 25 ft below bottom depth where the river mud was found to have a density giving it a weight of 90 lb per cubic foot.

Result of these deliberations was choice of pipe which was 26-in. OD x 1⅛-in. wall thickness.

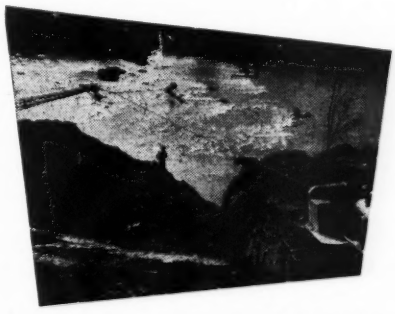
Taylor Forge & Pipe Works produced the pipe in its Chicago plant. Each joint of pipe was stress relieved after welding and each weld inspected by X-ray to provide the most selective control in manufacture.

Since it is planned to operate the Hudson crossing at a maximum gas pressure of not more than 400 psi, thus obviating the necessity for any special steel to overcome hoop stress in the pipe, it was decided to choose a steel with composition which would assure the utmost in ductility and toughness.

In collaboration with Louis Pentzien of Omaha Dredge & Dock Co., contractors for the Hudson crossing, Transcontinental has worked out a special method of installing the pipe. The method involves use of air and water jets. A small diameter jet pipe with specially designed slots will be clamped on the under side of the river crossing pipe and connected to water and air supplies on barges on the river surface through special hose connected along the length of the pipe crossing.

The jetting will be controlled by means of specially designed automatic valves uniformly spaced along the length of the jet pipe.

After the river pipe is pulled into place and laid on the bottom of the river, the jetting operations will be carried on uniformly back and forth across the river until the entire crossing length is let down to the depth of 25 ft below river bottom.



. . . crossing the rivers

It has been learned in laboratory tests that as the river mud is lubricated by addition of water and agitated by addition of air, the main pipe will tend to sink to the proper depth because of its own weight—and on reaching this depth will keep a firm position in place after consolidation of the river mud, which is expected to occur within two or three days after jetting operations have been finished.

A long series of barges will be stretched along the west bank of the Hudson, and it is planned to weld the pipe into a continuous pipeline on these barges. An automatic welding machine technique submerged arc process will be used.

The line will be pressure-tested before being lowered into the river and each weld will be inspected by X-ray. The complete line will be coated with a ⅝-in. thickness of Somastic coating.

Atchafalaya Bridge

Of great interest also is the crossing of the Atchafalaya river in Louisiana with the longest pipeline suspension bridge so far attempted. This bridge will have an over-all length of 3650 ft, main span length of 2000 ft and tower height of 108 ft. Plans for the bridge presented a considerable problem, in view of the depth, width, and swiftness of the river.

Water is about 50 ft deep at the point of the projected crossing. Government

hydrographs indicate the river bottom is subject to severe scouring action, with an indication that depth at the crossing could reach about 100 ft in a few years.

Mr. Chilson and the other engineers concluded that this scouring of the bottom could bring about loss of an underwater crossing unless the pipe could be installed lower down than the probable scoured depth. This would lead to a tremendous job of dredging.

They considered a submerged weir type of crossing with two continuous rows of interlocking sheet piling driven on a batter to a point below the probable future scouring of the bottom, with the pipeline laid in a concrete mass poured between the rows of piles.

But the unknown effect of scouring, which might have resulted from placement of a lateral obstruction on the river bottom, led them finally to give up this plan and substitute the suspension bridge, although the bridge is probably the most expensive crossing in this instance.

Mr. Chilson pointed out that normally a suspension bridge of the sort needed to cross such a river would be the least costly of different kinds of crossings. But in the Atchafalaya river bottom, core borings indicated no solid foundation material above a depth of about 130 ft below river bottom.

The following problems will add to the cost of the Atchafalaya bridge:

1. Considerable extra height is required in order not to restrict the movement of quite large ships which use the river.
2. It is necessary to install caissons at a very great depth below the river bottom.
3. It will be necessary to relocate part of the main levee on the west bank of the Atchafalaya to get proper clearance for installation of the west caisson.
4. Part of Louisiana State Highway No. 582, paralleling the levee, will have to be relocated.

It is planned, in addition to the suspension bridge across this river, to install an auxiliary three-line crossing on the river bottom. Continuity in the main pipeline, between the source of gas and the eastern part of the system will thus be provided before the bridge is finished.

There will be three 12-in. lines laid about 50 ft apart. The purpose of this design is to permit motion in the pipes which might be necessary in case of severe scour to the river bottom, thus permitting the profile of the pipes to conform with the bottom of the river at all times.

The pipes are being laid also with a means for movement in the large bend on the east side of the main channel, thus enabling the lines to pay out additional length in the event of bottom scouring. The lines in the portion of the bend will be laid on pipe stringers. This will provide a means for slippage if the main channel deepens and the pipes tend to sink.

TWO TRENCHES, each 20 ft deep, will be dredged by Texas Gas Transmission beneath the Mississippi near Greenville, Miss., company officials announced last month.

The river is so swift at this point, and so deep, that never before have underwater crossings been attempted. Texas Gas' project is possible because of development of special, new dredging equipment, spokesmen said.

The Atchafalaya has turned out to be the most treacherous of all crossed by major pipelines.

Not only the Hudson and the Atchafalaya, but every river crossed by Transcontinental, requires special thought as to the best crossing from points of view of security and economy. The 40 important rivers have a total crossing length of more than 12 miles.

Length of the principal crossings ranges from the 250-ft Saluda river in South Carolina to the 5000-ft Hudson separating New Jersey from New York.

Among the 40 rivers, plans call for nine to be crossed with multiple lines, 27 with single lines, and four with aerial suspension bridges.

In selecting the type of crossing, a number of factors are considered.

The following factors are likely to lead to a single under-water crossing: stable bottom and bank condition; slow current; locations distant from the market area; and short crossing length.

Where they have decided on multiple underwater crossings, the engineers have been influenced by the following: swift currents that might tend to cause failure in pipe of diameter sufficient to carry the entire capacity in one line; locations near market area where failure of the river crossing would shut off gas supply before emergency measures could be taken; unusually long crossings.

The following factors have tended to selection of suspension bridges: exceptionally steep and high banks; unstable bottoms subject to movement and erosion; great depth of water.

The four suspension bridges will be across the Colorado and Brazos rivers in Texas, the Atchafalaya in Louisiana, and the Coosa river in Alabama.

As ultimate load, these bridges are designed to carry two 30-in. x .375 wall thickness pipelines.

The Colorado bridge will have a tower height of 118 ft, over-all length of 1180 ft, and main span length of 550 ft.

Brazos river bridge: Tower height, 86 ft; over-all length, 1416 ft; main span length, 750 ft.

Atchafalaya river: Tower height, 108 ft; over-all length, 3650 ft; main span length, 2000 ft.

Coosa river: Tower height, 218 ft; over-all length, 1100 ft; main span length, 700 ft.

The bridges over the Colorado, Brazos, and Coosa rivers will be roughly comparable in size. One of these, that over the Coosa, was finished in March.

Angular riser pipe running from the bridge down into the earth provides means for motion in both horizontal and vertical planes caused by expansion of the pipe and movement in the bridge suspension system.

Multiple lines are serving to cross the Sabine, Trinity, Mississippi, James, Potomac, Susquehanna, Delaware, and Raritan rivers. Two lines, in each case, will extend from headers on each side of the river wth 24-in. OD x .937-in. wall thickness pipe being used.

Thorough study of the subject led to choice of a heavy wall thickness pipe for these crossings, to provide uniform negative buoyancy, and structural strength in the river pipe.

Mr. Chilson pointed out that the cost of using heavy wall pipe is no more than the cost of adding cast iron river clamps to hold down pipe of lesser wall thickness. It also is felt that considerable saving can be effected in eliminating the difficulty of buoying the pipe without clamps.

Another advantage considered gained is that heavy wall pipe provides added protection against externally caused pipe damage.

In general, in rivers with soft bottoms, crossing pipe is being installed with 10 ft of cover, and in rivers with rock bottoms, with 1 ft of cover.

In every instance, in order to prevent possible loss of the crossings from erosion and cutting of the banks, the river banks are being cut back as far as possible.

An unusual angle of the Transcontinental line is that it ends within the boundaries of a river. The terminal meter station of the entire line will be located on a specially constructed steel and concrete pier, 40 ft offshore of the Manhattan side of the Hudson river in New York state. The meter station will be 2 ft outside the bulkhead line. At this point the gas will go into control of the New York companies. The pier will be of unusual design in that its long dimension will be parallel to the Manhattan shore. It will stretch 110 ft along the shore and 42 ft out into the water.

Contractors who have installed or are installing river crossings on the Transcontinental system are Austin Bridge Co., American Bridge Co., Kansas City Bridge Co., Massman Construction Co., Pittsburgh Des Moines Steel Co., Omaha Dredge & Dock Co., L. E. Farley Inc., and Anderson Bros. Corp.

Tallapoosa Crossing Proves Rugged Task For Midwestern

THE job of putting the 30-in. Transcontinental line under the Tallapoosa near Wadley, Ala., is the toughest encountered by Midwestern Constructors Inc. along the two sections of pipeline the company built through Alabama and Georgia.

Blasting a channel 5 ft deep across the Tallapoosa's 318-ft width required more than 5000 lb of explosives. Swollen waters and swift current hampered drilling, slowed the digging out of shattered rock, threatened the positioning of tons of heavy steel pipe.

Standard equipment on Midwestern's heavy duty bulldozers and earth moving machinery, Jones & Laughlin Steel Corp.'s wire rope played a vital role throughout the operation.

The right-of-way approach to the river on the east bank is a 25° grade. The west bank approach is 7°. Banks were cut to the river edge by the right-of-way crew.

On Jan. 7, wire rope cables were strung across the river to support and anchor equipment against the river current. The crossing operation to put the 30-in. pipeline a minimum of 2 ft under the river bottom was underway.

Drilling was started off the west bank. Suspended from a side boom tractor, a wagon drill consisting of two air hammers on a yoke began pounding down holes 2 in. in diameter, 5 ft from center to center, in the river bottom.

With 62 holes drilled, on Jan. 11 the river began to rise and threatened to fill the holes unless longer casing was installed. A test shoot was made to determine the nature of the bottom and the adequacy of the 2-in. holes.

In the explosion 1240 lbs of 60% Hi-Velocity gelatin dynamite was used. Bulldozers, a back hoe, and a clamshell cleaned out the blasted rock. Preliminary sounding indicated the shoot successfully blew out a trench 5 ft deep in the rock for a short section.

Water along the west bank of the river was 3 to 4 ft deep for nearly 150 ft out from shore. The remainder varied down to 8 ft deep. On Jan. 14, drilling operations were resumed in the shallower section of the river. To drill the deeper section, a water well drill which made holes 6 in. in diameter was used.

During drilling, the well drill was floated on two army surplus pontoons used during the war for portable bridges. The pontoons, inflated by air compressor, were secured to wire rope anchor cables suspended across the river. Additional pontoons were used to carry out other phases of the operation.

For passenger traffic back and forth across the river, a wooden row boat was put in service during one phase. Three different times the boat capsized in swift current. Once Bruce Williams, foreman, and another crew member were swept down river. They were saved only after a long struggle to reach shore, and narrowly escaped the casualty list. The boat was lost.

While sounding the river bottom, Engineers William Daniels and Ned Chandler were in a boat which turned over. They leaped for the wire rope life lines and pulled themselves hand-over-hand some 100 ft to the shore in another close escape.

By Feb. 1, 38 holes 6 in. in diameter and 70 holes 2 in. in diameter had been drilled in the bottom. It was estimated that enough explosive could be packed into them to complete the 5-ft trench across the river.

In all, 3500 lbs of explosives were used for this one shoot. Holes were cleaned out by air jet. Into the large holes went 5-in. by 24-in. cans of Nitramon and Nitramex. In the smaller holes, 60% Hi-Velocity gelatin dynamite was used. The entire charge was connected with Primacord.

At 9:46 a.m. the charge was detonated. The explosion blew water, rock, and steel pipe casing nearly 1000 ft in the air.

. . . crossing the rivers

Again bulldozers, back hoe, and clamshell began to clean out loose rock and heavy boulders from the trench in the river bottom. Sounding disclosed one or two locations which required additional blasting. More than 500 lbs of explosives were used at various points in "adobe" charges on the bottom to complete the trench.

Meanwhile the pipe bending machine was in operation, giving the proper curve to the pipe to fit the contour of the granite river bottom. Because of U-shaped slopes about 75 ft from the east bank, two bends were required in the river sections.

Thirty-foot lengths of pipe had been welded end-to-end into three sections. Two sections were 120 ft long and one section was 150 ft long. On the river end of the first section of pipe, a "bull plug" was welded across the pipe end to seal it. Two holes were cut in the bull plug and a piece of 2-in. pipe was inserted and welded in position. Around the pipe was fastened a 7/8-in. J&L wire rope cable, capable of withstanding loads up to 32 tons.

The cable extended across the river to the drum on a winch tractor anchored to the hillside. At 8:50 a.m. the tractor began pulling the first section of pipe into the water. Four side boom tractors carrying the pipe in wire rope supported slings, guided the pipe into the river, preventing it from scraping on the river bank. Because of its sealed end, the pipeline was buoyant in the water and the weight on the cable pulling it across the river diminished as the crossing progressed.

When the first section was in the water, the second section was welded to the end of it, and a second pull was made until both were in the water. Then the third section was welded to the end of the second section, and the entire 390-ft length was moved into final position. It was nested into the trench prepared for it, where river deposit will cover it over.

The pipe ends were welded to the approaching sections of the main line already in the ground, and another gap in the pipeline was closed—one more step completed on the long and difficult pipeline trail to New York City.

Superintendent on the job for Midwestern was Clyde Peters, a veteran of 21 years experience in pipeline construction. He has worked on lines in 32 different states. During World War II, he spent 15 months in the China-Burma-India theater with the general service engineers.

The sections of pipeline completed by Midwestern were subcontracted from Fish Engineering Corp., Houston. Midwestern, which has headquarters in Tulsa, Okla., has standardized on J&L wire rope for all heavy duty equipment.

PIPELINE OPERATING IDEAS

A VENTED WELDING REPAIR PATCH

Frank R. Arment, Panhandle Eastern Pipe Line Co. welder, added to his spring bankroll to the tune of $50 with his suggestion for a vented welding repair patch, now in use by the company's western pipeline division.

Mr. Arment's repair patch is used to repair pit-hole leaks on the main lines, and in some instances, to repair cracked welds and broken taps. The patch is fabricated by welders in shops before being taken to the job.

Here are the details of fabrication and materials used in making the patches:

1. The patch is made of seamless pipe the same size of pipe which is to be repaired. A 30-in. x 30-in. pattern is laid out on the pipe of size desired to make the repairs necessary. A ⅛-in. or 3/16-in. vent hole is drilled at one corner of the pattern about 3-in. or 4-in. in from edges of patch.

2. A circular hole is to be centered in the 30-in. x 30-in. pattern and cut out. This forms a shoulder for holding a transite pipe coupling rubber which is used as a seal to seal and vent gas off for safety while patch is being welded to the line.

NOTE: This hole for the transite pipe coupling rubber is determined by size of rubber used to seal off the pitted area of pipe to be repaired.

NOTE: The coupling rubbers are ½-in. in diameter and are available in 2, 3, 4, 6, 8, 10 and 12-in inside diameter sizes. In the event a 2-in. rubber is used, a 3-in. hole is required to use it in the patch, etc. Correct name of the rubber is "Transite Pipe Coupling Rubber, Std., Class 150."

3. A circular piece of pipe is cut from the same outside diameter pipe for which patch is fabricated, 2-in. larger in diameter than the size of the hole for the rubber gasket used to seal off the leak. This is welded to the 30-in. x 30-in. pattern mentioned in Paragraph 1 and completes the seat for coupling rubber mentioned in Paragraph 2.

4. A 1½-in. extra heavy steel coupling is to be welded in the center of piece mentioned in Paragraph 3 and makes the vent connection for the escaping gas. This coupling size should be used on all patches to eliminate the necessity of carrying more than one size of pipe and fittings to convey escaping gas away from the repair work. Piping can be of any length desired on the vent, but in the event of patching in a bell-hole, piping should be at least above the surface of the ground. After the welding of the 1½-in. coupling is completed, a tap should be inserted in the coupling to free foreign matter from threads, allowing certain and easy installation of the 1½-in. bull plug.

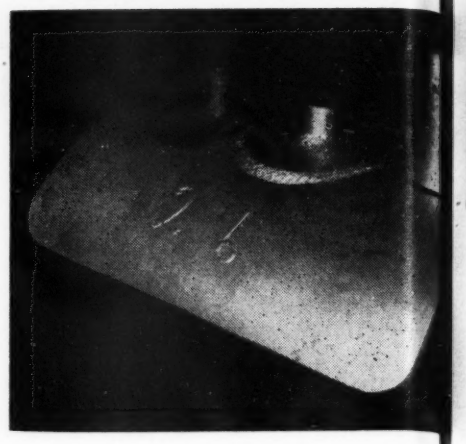
5. After welding has been completed on the coupling, the 30-in. x 30-in. pattern is then cut out of the pipe making the patch ready for use.

NOTE: Welding should be done before cutting patch out of pipe due to possible drawing of the pipe while welding.

6. The patch being ready for use now, it is held in place on the pipe with the aid of two chains and two hydraulic jacks. With the aid of a chain and jack on each end of the patch, the patch is drawn tightly against the pipe to be repaired and draws the transite pipe coupling rubber down, sealing the escaping gas off so it is forced to leave through the 1½-in. coupling vent and piping.

7. After vent piping has been installed to vent for safety, the patch is ready for welding to line to make repairs. The welding being completed on the patch, the ⅛-in. or 3/16-in. vent hole in the corner of the patch can be welded shut. The chains and vent piping are then removed.

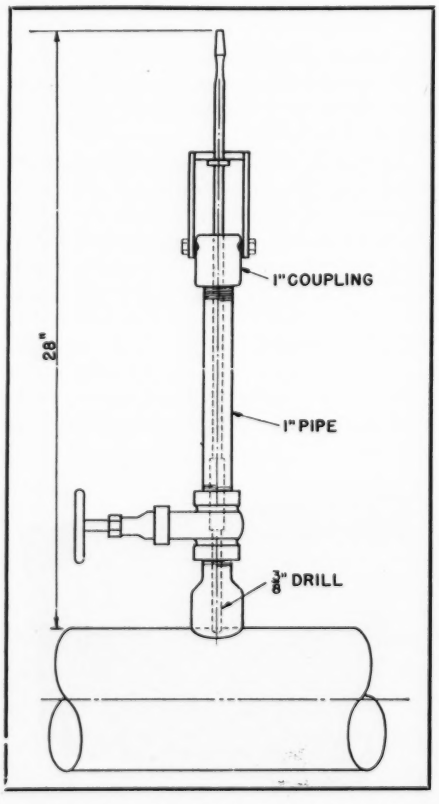
8. A 1½-in. seamless steel bull plug slotted in several places to allow ease in inserting into steel coupling is then inserted, tightened, and welded. (The slotted end of bull plug allows the escaping gas to get away until sufficient threads hold bull plug against the pressure created. In event of excessive gas escaping, a swedge nipple and gate can be used to stop the flow of escaping gas. Valves from sizes ¼-in. up to and including 1½-in. can be used.



9. A bull plug is made of a 4½-in. OD extra heavy weld cap and extra heavy seamless pipe 8-in. in length overall and is welded over the 1½-in. coupling and bull plug. A ½-in. tapped hole in weld cap is closed with a ½-in. steel plug and welded. This completes the repair and it is now ready for painting, wrapping and backfilling of the hole.

NOTE: In the event the 30-in. x 30-in. patch covers too much area, it may be cut down in size, but always be sure to allow enough space from the rubber gasket so that it will not be burned while welding is being performed. In the event a valve is required in Paragraph 8, the 4½-in. OD bull plug will have to be enlarged accordingly.

NEW TAPPING MACHINE DESIGN



Both operating ideas courtesy *Panhandle Lines*, Panhandle Eastern employee publication.

Panhandle Eastern's R. J. Williams, foreman of the company's district No. 3, won $25 for his suggestion for design of a tapping machine.

The home-made machine is being used successfully in the installation of farm tap settings in district No. 3. It has been tested at 1000 psi.

This tapping device is practical and handy for installation of farm tap settings or other similar taps requiring a small hole in the line. The device is pocket size in comparison with like machines and it is easily applied. It can be installed and removed, including the drill of a ⅜-in. hole, within five minutes time. A like machine used by the company in the past did not allow drilling holes smaller than ⅞ in. Where volumes of gas do not require large orifices, Mr. Williams believes that the smaller orifice is better from an operating standpoint.

For instance, if a farm tap was broken off, a repair against pressure or the flow of gas would be much easier and possible with the small orifice than one with the large orifice, thus reducing the possibilities of lowering line pressures or shutouts, including the reduction in gas loss in emergencies of this kind.

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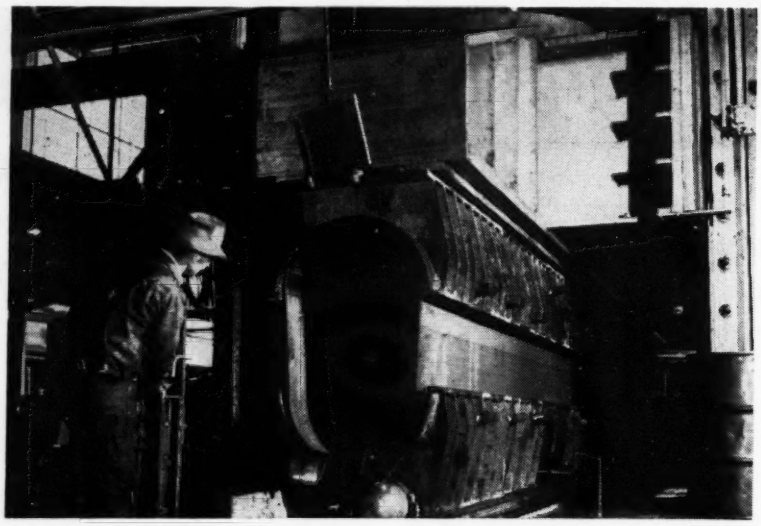

"U"-ed section plate in press at Napa plant which will give it circular form. The pipe is formed between two dies which leave the edges in perfect alignment for welding.

KAISER WINS FAT TRUNKLINE ORDER

WHEN Trunkline Gas Supply Co. received FPC authorization May 4 to build an $80 million, 1200-mile gas pipeline from the Texas Gulf coast to a point near Decatur, Ill., it proved a real bonanza for the fast-growing Kaiser Steel Corp.

For Kaiser, new California giant in the manufacture and marketing of large-diameter high-pressure steel pipe, pocketed a fat $35 million contract to supply the 257,000 tons of tube that will go into the 26-in. trunk—thereby stacking its total orders for oil and gas pipe past the $100-million mark. Tonnages now aggregate more than three-quarters of a million.

Biggest of the Kaiser orders is the 470,000-ton, 1840-mile Texas - to - New York line which Transcontinental is building. The Fontana - Napa (Calif.) organization is also supplying Texas Eastern Transmission Corp.'s Big Inch expansion job.

Trunkline, which will carry an initial 250 MMcf from McAllen, Texas, to a connection with Panhandle Eastern Pipe Line Co.'s main line running to the Detroit area, will use 167,000 tons of 26-in. throughout its 773-mile main system, while the 427 miles of gathering line will take 90,000 tons of 10 to 24-in. pipe.

Varying wall thicknesses are specified for the network, as indicated in the table.

Size	*Wall Thickness*	*Approx. Net Tons*
26	5/16	164,600
26	1/2	3,000
24	9/32	40,200
24	1/2	1,500
20	1/4	19,800
20	9/32	23,100
20	1/2	1,000
16	1/4	2,000
12 3/4	1/4	1,000
10 3/4	1/4	1,400

Kaiser has set up a highly efficient organization to market the big tube. Under a joint agreement, Basalt Rock Co. fabricates the pipe at its Napa plant from plate rolled at Kaiser's Fontana mill, and Kaiser's sales department carries on the marketing.

Ingot production is now at a steady 1.2 million tons per year, and plate production is right at half a million, assuring speedy fulfillment of orders.

At Fontana, open hearth steel ingots are melted and rolled into slabs of proper size on the 36-in. blooming mill. The conditioned slabs are rolled into plate on a 110-ft plate mill, consisting of two stands, a two-high reversing, roughing mill, and a three-high finishing mill. At the option of the operators, light plate may be finished on a four-high, four-stand, 86-in. continuous mill.

The specification requires that plate rolled for this pipe shall meet the following minimum physical values:

Tensile strength	72,000 psi
Yield strength	41,250 psi
Elongation 8-in.	18%

At Basalt Rock Co.'s Napa plant in the San Francisco Bay area, plate, usually in 40-ft lengths, is first cut to accurate width and pickled to remove mill scale. An additional advantage claimed for pickling is reduction in die wear and longer maintenance of accurate die dimensions. The plate then passes through a set of profile rolls which progressively bend its lateral edges to the correct cylindrical radius. Simultaneous with this operation, edge roughness is corrected and the edges are wire brushed to insure smooth, clean longitudinal seams. The edge-formed plate moves into a U-ing press where a die of partial cylindrical section, 40 ft in length and mounted on the rams of two synchronized hydraulic presses, forces the plate through roller dies and gives the U the desired curvature.

The U section advances to the dual-cylinder O-ing press and is there formed into a cylinder within its split cylindrical dies.

According to Basalt, press-formed pipe is roll-formed in that it is die-formed to exact shape in dies having almost no spring or flecture. Die - formed cylinders, being more nearly perfect, have less unbalanced internal stresses and leave less work to be done in later operations, and produce pipe of more uniform dimension.

At Napa, pipe under 24-in. OD is single-pass welded with 100% penetration, then passed through straightening and sizing rolls which slightly reduce the pipe's diameter and not only give the pipe good concentricity, size, and straightness, but also raise the yield strength of the metal and, to a lesser degree, its tensile strength.

Pipe of 24-in. to 30-in. diameter is made by the expanded pipe method. The longitudinal seam is welded by the submerged arc method in two passes in specially designed welding machines. The dual electrode welding head for making the inside weld is carried on a boom which traverses the length of the pipe. By making the inside weld first, the line of the seam is maintained and the weld bead is deposited with great accuracy. The adjustable head of the outside welder is mounted in a stationary fixture through which the pipe passes as the weld is made. In this operation the weld seam is again accurately placed, since direct visual observation affords the operator opportunity for close adjustment of the electrode travel.

Next, the ends are machined square and the welded pipe is placed in expanding dies within which the ends are mechanically expanded and the body of the pipe hydraulically expanded about 2% to its final diameter. During expansion, the pipe is formed true to size, and concentricity and its physical properties are improved by the cold working of the metal.

Following expansion, the pipe is hydrostatically tested. The pressure is dropped to the test pressure, the restraining expansion dies are removed, and the weld seam is struck hammer blows along its length, while under pressure. The ends are then machined to accurate squareness and beveled for welding. Final visual inspection is then made.

Sixteen lengths of 26-in. pipe are loaded in a car for shipment without coating.

With construction of the Trunkline system getting under way in May, initial shipments of 5000 tons have already been made. The tempo of deliveries will increase until a 26,000-ton-per month rate is achieved next year. Complete fulfillment is anticipated by mid-1951.

* * * * * *

At Panhandle offices, meanwhile, it was announced that financing of the Trunkline program has been arranged. Panhandle owns 60% of the Trunkline stock. Panhandle vice president and treasurer Hy Bird has been elected president of Trunkline, with offices at Houston. Leslie T. Fournier, another Panhandle vice president, was elected treasurer to succeed Mr. Bird.

With a $35 million outlay also planned to boost Panhandle's own system capacity by 50 MMcf, completion of the Trunkline web will raise the combined capacity past the 800 MMcf mark.

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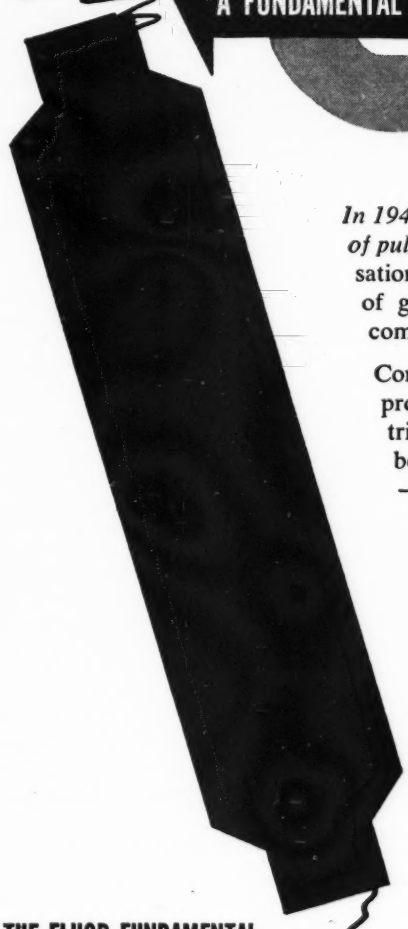

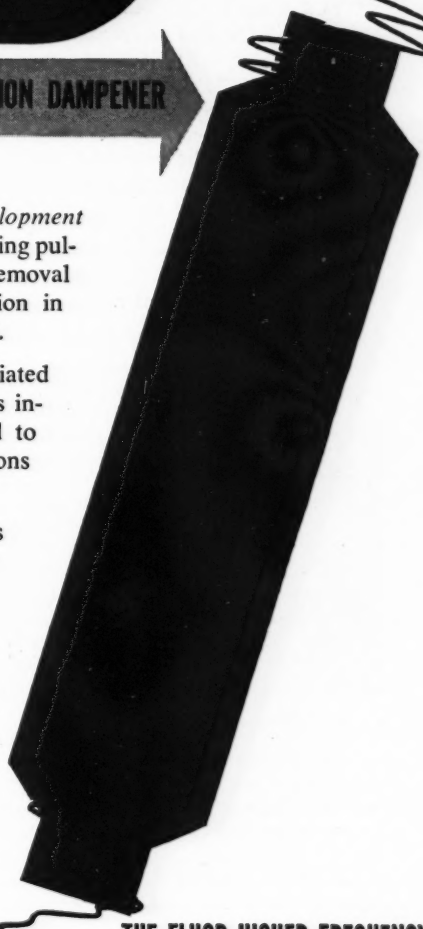

In 1943, The Fluor Corporation pioneered the development of pulsation dampeners. The first U. S. Patent covering pulsation dampeners designed specifically for the removal of gas stream pulsation and subsequent vibration in compressor piping was issued to Fluor in 1946.

Continued research in gas pulsation and its associated problems has established that pulsation, and its intricate secondary vibration, can be attributed to both fundamental and high frequency pulsations *—or to high frequency components alone.*

Whichever of these destructive conditions exists in your plant, Fluor offers a dampener engineered to fit the requirements of the specific problem. Fluor—and only Fluor—offers such a complete range of pulsation dampeners. For this reason you can be assured of an unbiased recommendation on the best type dampener for your *particular* requirements.

THE FLUOR FUNDAMENTAL PULSATION DAMPENER

This type dampener smooths out all pulsations in the gas stream to the extent of at least 85%. All harmonics originally set up in each pulse cycle are automatically reduced or eliminated. This dampener is the guaranteed answer in plants where structural vibration and metering difficulties are encountered—irrespective of pulsation frequency.

MAKE YOUR OWN PRELIMINARY SURVEY

In many cases you can make your own preliminary survey to determine roughly if your pipe vibration is caused by pulsations. Write The Fluor Corporation, Ltd., Los Angeles 22, California, indicating layout of compressor house piping and operating pressures. A procedure will be mailed to you promptly. No obligation.

THE FLUOR HIGHER FREQUENCY PULSATION DAMPENER

This dampener removes objectionable pulsation frequencies encountered above the fundamental. In many instances, it has been found that metering difficulties and vibration of compressor piping and nearby vessels have been caused by the higher frequency components alone. Available in both manifold and in-line types, this dampener is competitive in cost with muffler or snubber type devices.

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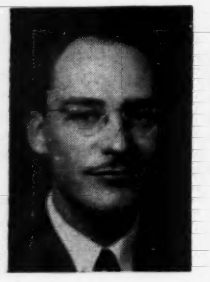
Pipeline People



W. E. Caine

C. L. Brockschmidt

... *Texas Eastern Transmission*

W. E. Stevenson

R. L. Boyer

... *Cooper-Bessemer Corp.*

C. L. BROCKSCHMIDT has been named vice president in charge of sales for Texas Eastern Transmission Corp., heading a list of five executives who have been named as vice presidents. The others are WALTER E. CAINE, vice president and treasurer; O. S. CARPENTER, vice president and comptroller; MILLS COX, vice president in charge of gas supply; and B. D. GOODRICH, vice president and chief engineer.

CHARLES A. BUTCHER joined Worthington Pump & Machinery Corp. on June 1 as assistant to the president. Mr. Butcher formerly was general manager of Crocker-Wheeler Electric Manufacturing Co. He will make his headquarters in New York. WALTHER H. FELDMAN, president of Worthington's subsidiary, Electric Machinery Manufacturing Co. of Minneapolis, has been named vice president in charge of sales for the parent company. Other recent promotions include the appointment of JOHN J. SUMMERSBY as vice president in charge of purchases, FREDERIC W. THOMAS as geenral manager of purchases, and CARLETON REYNELL as general representative, sales and purchasing departments.

W. H. Feldman

Grover Seaberg

GROVER SEABERG, who has been conducting a foundry business in California for the past 10 years, recently joined Middle West Coating & Supply Co., Tulsa, as west coast representative. Mr. Seaberg began has career as a chemist for Peoples Gas Light & Coke Co., Chicago, and he was also associated with Dresser Coupling Co., Pittsburgh Equitable Meter Co., and the Walworth Co. before establishing his own business.

M. W. KIBRE, assistant manager of the gas department, General Petroleum Corp., Los Angeles, since 1945, has replaced H. L. EGGLESTON as manager.

RALPH L. BOYER, vice president and chief engineer of Cooper-Bessemer Corp., Mount Vernon, Ohio, and WILLIAM E. STEVENSON, president of Oberlin (Ohio) college, recently were elected to the Cooper-Bessemer board of directors. Mr. Boyer has pioneered such developments as the dual-fuel engine, Turboflow, and super-charging of 4-cycle spark-ignited gas engines. Mr. Stevenson was selected because of his background and experience, particularly in the field of public relations. ROBERT P. RAMSEY, authority on industrial market research and product design, has been employed by Cooper-Bessemer to expand the company's research and development program. He will work under the direction of Mr. Boyer.

Pipeline Newsnotes

Worthington Pump & Machinery Corp., Holyoke, Mass., has announced availability of its new 500-ft pipeline "Blue Brute" model portable air compressor. Designed to give top performance in rugged terrain, the unit is equipped with a special oil bath air cleaner, a steep angle oil sump, and a readily accessible heavy-duty replacement cartridge oil filter.

Transcontinental Gas Pipe Line Corp., which is trying to build an 1840-mile line from Texas to New York City, has been forced to file suit in Newark federal court to enjoin city officials of Milltown, N. J., from interfering with construction. The little municipality was worried that it might be blown off the map by the strange new gas.

Two new major gas producing wells, at opposite ends of the country, have recently been brought in. Stanolind Oil Co. reportedly made a wildcat strike at 2500 ft in La Plata county in the San Juan basin in Colorado, near the New Mexico border. Production was said to be 5 MMcf per hour. And at Nora, Va., Clinchfield Coal Corp. hit a 5.1 MMcf per day producer at 4000 ft.

The cities of Ripley, Booneville, and Baldwyn, all in Mississippi, have requested a Federal Power Commission order directing Tennessee Gas Transmission Co. to connect its facilities with those to be built by the cities for delivery of TGT gas to Ripley, Blue Mountain, Booneville, Wheeler, and Baldwyn. The three principal cities in the request would build and own different segments of the lines.

ALGONQUIN ON THE STAND

Hearings start for second northeast line

Algonquin Gas Transmission Co.'s scheme for supplying natural gas to New England went into FPC hearings June 12 in Boston, but as *GAS* went to press neither this plan nor the competitive Northeastern Gas Transmission Corp. plea was anywhere near a decision.

New developments have been turning up almost daily. A few highlights:

On June 1 the Massachusetts legislature reported favorably a bill to require gas and electric companies in the state to divorce themselves from natural gas pipeline companies. The target for this unique bill was Algonquin, organized by New England Gas & Electric Assn. and Eastern Gas & Fuel Associates. Politics was charged in some quarters by observers who felt that New England legislators are trying to use big utility companies as scapegoats for political gains.

Algonquin's offer to split the territory with Northeastern was reportedly looked upon with approval by new FPChairman Mon C. Wallgren, who thought that there were plenty of customers for both.

The 18 utilities in the New England Electric System signed with Northeastern for gas to supply 218,000 customers.

What it termed the "world's largest single gas supply contract" was signed by Texas Eastern, Algonquin supplier, with United Gas Pipe Line Co., Shreveport. Annual deliveries of 134 billion cu ft, almost twice the amount needed to supply Algonquin, were reserved. This act followed the filing of a Texas Eastern application with FPC in May for a new 931-mile line to supply 476 MMcf per day to Algonquin and present customers, and the subsequent application to develop the world's largest gas storage field (200 MMcf per day delivery capacity) by Texas Eastern and New York State Natural.

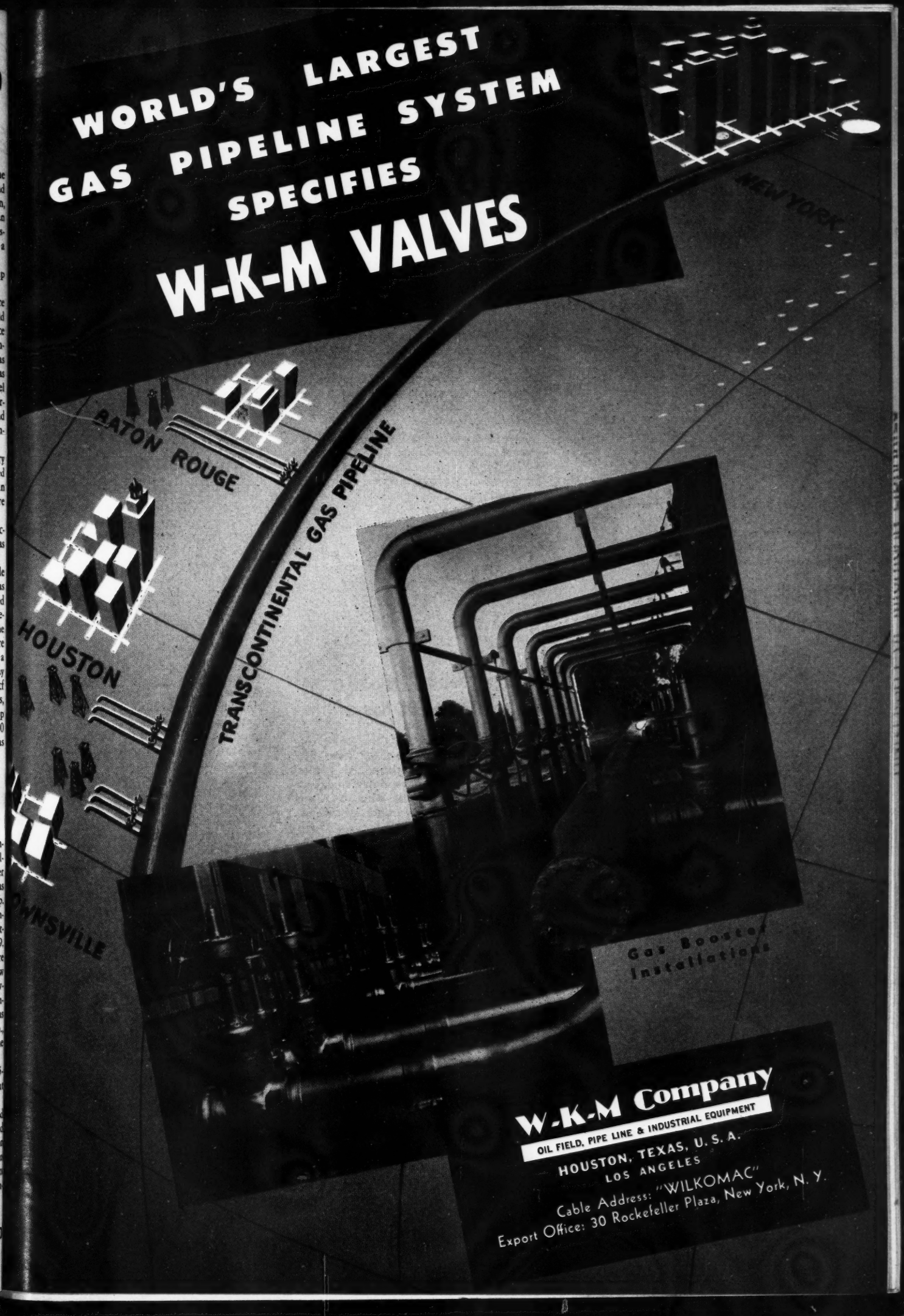
Huge Pennsylvania Storage Idea Submitted to FPC

A joint proposal to build and operate underground storage fields in western Pennsylvania has been filed with the Federal Power Commission by New York State Natural Gas Corp. and Texas Eastern Transmission Corp.

Combined cost of the project, which involves the Oakford storage area in Westmoreland county, would be $38,752,769. New York State's part of the expenditure would amount to about $20 million. New York State wants the gas for peakload deliveries to its affiliated companies in the Consolidated system, particularly East Ohio Gas Co., Cleveland, and Peoples Natural Gas Co., Pittsburgh. Texas Eastern would also use the gas for winter delivery to its customers.

The two companies propose to put a 45-billion cu ft cushion in the fields, with about 60 billion cu ft of circulating gas.

Under the plan, New York State would build a 70-mile, 20-in. line from the Oakford fields to connect with East Ohio's system on the Pennsylvania-Ohio border. Texas Eastern would build a 35-mile, 30-in. line from its present transmission system in Fayette county, Pa., to the Oakford area.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STALL IN CALGARY

Export case recessed; new firm in picture

The question of whether the Northwest will receive natural gas from the Canadian province of Alberta is stalled again.

Hearings on export permits for Northwest Natural Gas Co., which got under way before the provincial conservation board in Calgary late in May, were adjourned June 10 for two months. And since Northwest was the first of three applicants (the others being Westcoast Transmission and Western Pipelines) to come to bat, the two competitors will also have some more sweating to do.

Possible further complication—although not directly connected with the Canadian consideration of the projects—was seen as Trans-Northwest Gas Inc., of Spokane, Wash., filed an application with the Washington highway commission for a franchise to lay lines along state highways. Trans-Northwest wants to transmit gas received on this side of the border to the various distributors. Seattle Gas Co. immediately intervened.

Trans-Northwest also made application to the Idaho Public Service Commision for permission to lay lines in that state.

The Washington highway hearings were twice postponed, are now set for Sept. 13.

Pipeline Construction Records Fall, Survey Reveals

GAMA'S statisticians have come up with another Natural Gas Construction Data study, this time bringing up to date pipeline construction totals through 1949. As usual, the figures are overpowering:

During 1949, FPC authorized 7536 miles of line costing $600 million, increasing *daily* delivery capacity by 3 billion cu ft, benefiting more than 100 cities of 50,000 or more population.

A new record.

On Feb. 1, 1950, applications pending authorization provided for an aggregate increase of 4.7 billion per day. If all are approved, another new record.

Since July 1, 1945, FPC has certificated 22,326 miles of line weighing 5.4 million tons and costing $1.4 billion.

Utah Natural Files Plan To Tap Four Corners Area

A pipeline that would bring natural gas from the "four-corners" area of southern Utah to serve industrial customers in the Salt Lake City area has been proposed to the Utah Public Service commission by Utah Natural Gas Co. Hearings on Utah Natural's proposal will get underway early this fall, commission spokesmen said.

The new company, headed by president John A .McGuire, intends to build for $25 million a 325-mile, 22-in. pipeline to take advantage of developed and undeveloped holdings in the southeastern corner of the state. Mr. McGuire said in Utah Natural's application that his company already has firm assurances of an "adequate supply of gas to meet commercial and industrial demands."

Utah Natural would invade the territory currently served with Wyoming gas by Mountain Fuel Supply Co., but would not be in competition with Mountain Fuel, Mr. McGuire said. He explained that Utah Natural has as its primary purpose the serving of industrial and commercial customers, supplies for which are allegedly not available to Mountain Fuel.

TGT Contracts for Gas From Louisiana Tidelands

Tidelands gas—gathered in the Gulf of Mexico and delivered to a transmission company on the mainland—will soon be surging to northern and eastern markets. A new company, Marine Gathering Co. of Houston, has been formed and will deliver Tidelands natural gas to Tennessee Transmission Co. on the Louisiana mainland.

Marine Gathering has announced its intention to build a 10-mile, 8⅝-in. line from the coastline of Vermilion parish, La., to Pure Oil Co.'s drilling platform 36 ft above the Rollover field in the gulf. The line will have a capacity of 50 MMcf daily. Marine Gathering president John H. Blaffer (also president of Commerce Oil Co.) said that the company has contracted with Pure Oil for natural gas from a large area of the Louisiana tidelands on which Pure Oil holds leases.

Other officers of the new company are G. Burton Liese, Houston investment banker, and Philip C. Dixon, Tulsa oilman.

Southern Natural Line To Seaboard Wins FPC Nod

Southern Natural Gas Co.'s 1950 construction plans got a go-ahead from FPC last month. The Birmingham (Ala.) company will build 496 miles of new high pressure lines from Gwinville, Miss., to Aiken, S. C., and about 310 miles of laterals, branches, and additions.

Southern's project will cost an estimated $32.9 million and will bring the company's daily delivery capacity to 529 MMcf. Compressor additions will total 11,600 hp and new compressor station will add 7600 hp.

Twenty industrial companies in Mississippi, Alabama, Georgia, and South Carolina will be served by the new facilities, and 45 communities in Alabama, Georgia, and South Carolina will benefit from the new transmission lines.

East Ohio to Tap TGT Trunk

East Ohio Gas Co. will be able to increase its receipts of natural gas from the transmission lines of Tennessee Gas Transmission Co. under a recently received FPC authorization for a pipeline-building project in northeastern Ohio.

The line will be 20 in. in diameter and will allow East Ohio to receive gas from the new TGT line extending north from Kentucky to Buffalo. The project will cost $982,565 and will be completed next fall.

PIEDMONT BACK IN RING

Joins new battle for right to serve Carolinas

Piedmont Natural Gas Co. Inc., a new company with an inherited history, has applied to the Federal Power Commission for authorization to buy the Carolina facilities of Duke Power Co., tie in to Transcontinental's Texas-New York system, and begin selling gas to cities in both the Carolinas.

The company's predecessor, Piedmont Natural Gas Corp., was the Wilmington, Del., corporation that recently lost a close FPC decision to Commonwealth Natural Gas Corp. Commonwealth won the commission's okay in its plan to serve gas to the Virginia market after a long wrangle with Piedmont, which wanted to build its own line from Texas to serve Virginia and the Carolinas.

Reformed under a new name, but with essentially the same personnel (William P. Conyers is president), Piedmont is back in the natural gas picture, this time holding contracts for the purchase of the Duke Power facilities and for gas from Transcon's line. It proposes this time to build laterals from the existing Duke Power system, and will sell gas to Charlotte, Winston-Salem, Greensboro, Salsbury, Spencer, High Point, Burlington, and Graham, N. C.; and Greenville and Spartanburg, S. C. Other cities that might be served include Asheville, Hendersonville, Hickory, Statesville, Lenoir, Concord, Kannapolis, Durham, and Raleigh, N. C.; and Rock Island, S. C. Under the new proposal, it no longer plans to build a pipeline from Texas.

Meanwhile, Transcon, which already has another company interceding in its expansion proceedings, also with service to the Carolinas in mind, has petitioned FPC for approval to sell gas to Piedmont and to Public Service Co. of North Carolina Inc. Transcontinental would sell an ultimate 22 MMcf of gas to Piedmont, and an ultimate 5.5 MMcf to Public Service—both after $5.4 million worth of additions to its facilities.

Meanwhile, Carolina Natural Gas Co. is still in contention as the company to serve the Carolinas. It has asked FPC orders directing Transcontinental to sell gas to it for resale in essentially the same market areas as proposed by Piedmont and Public Service. It would undertake a pipeline project almost the same in description as those of the other two companies.

Iroquois Storage Plan Affirmed

Development of three new natural gas storage fields and the enlargement of an existing one will be undertaken by Iroquois Gas Corp. this summer, under an authorization just received from the Federal Power Commission. Included in the authorization was a proposed 23-mile pipeline.

The program is designed to facilitate solving of peakload problems and will cost about $2 million. Two of the new storage fields are in Erie county; the other is in Wyoming county. Iroquois will enlarge a field in Erie.

The pipeline to be built will facilitate transmission of gas to and from the proposed Holland and Bennington fields.

For steel, cast iron and Transite pipe. Single massive bolt simplifies installation. Immediate deliveries from stock.

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CAROLINA LINE

Another plan to serve 39 cities filed with FPC

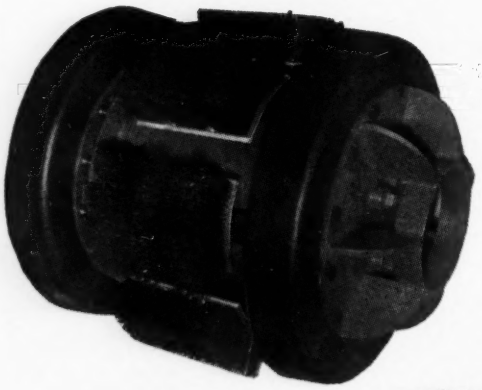
A second application for pipeline construction that would bring natural gas to communities in North and South Carolina has been filed with FPC. Public Service Co. of North Carolina Inc., Gastonia, has asked the commission's approval of its plan to tie in with Transcontinental's main line at 10 different points, build 365 miles of distribution lines, and thereby serve 39 Carolina cities.

The company, which now owns manufactured gas-producing facilities and distribution systems in North Carolina, wants to acquire the distribution facilities in the cities and towns it proposes to serve. If acquisition is not possible, Public Service proposes to sell wholesale to local distribution companies; if no distribution facilities exist, it would build them. Eventual annual requirement would be about 21.2 billion cu ft, which Public Service wants to get from Transcontinental. It has asked FPC to direct Transcon to deliver gas at the 10 points where proposed connections would be made.

Public Service Co. of North Carolina expects the cost of its program to approximate $7 million.

A similar application is on file with FPC already, with Carolina Natural Gas Corp. as applicant. Carolina Natural's proposal closely parallels that of Public Service.

Williamson Gas Line Pigs* Traverse 1½R 90° Bends



← 24" Size New Design TYPE GP PIGS with Brushes Mounted on Arched Springs to Compensate for Wear

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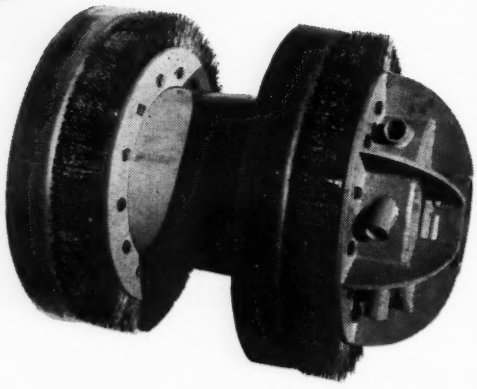

*Patents Pending

Above Designs Available in 16" and Larger. Other Designs as Small as 2".

THE PIG WITH THE POKE CLEANS PIPE LINES

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Transcon Wants 11-Mile Extension on New York Line

Transcontinental Gas Pipe Line Corp. will make an 11-mile addition to the current construction of its 1800-mile Texas-New York line if FPC okay is given on the company's latest application.

Transcon wants to build the addition, consisting of 20- to 26-in. pipe, from a point on the previously authorized mainline near East Carteret, N. J., into Brooklyn. The company says that this addition will obviate any interruptions in service to the New York metropolitan area and provide gas for all the companies serving New York City (Brooklyn Borough, Brooklyn Union, ConEd, Kings County Lighting, and Long Island Lighting).

Transcon estimates that the cost of the new line will be $3,585,000.

More Gas For Nebraska Urged

Kansas-Nebraska Natural Gas Co. has asked an FPC go-ahead on a proposed plan by which it would up its present natural gas capacity to 146 MMcf daily.

Four Nebraska towns would benefit by the increase, the company said, and increased demands of present customers could more easily be met.

The program proposed by Kansas-Nebraska would cost $729,331, and includes the addition of 1640 hp in compressor stations, a four-mile pipeline from the company's system to Pleasanton, a station there, replacement of 16 miles of pipe in the vicinity of Colby, Kan., 22 miles of pipe near North Platte, Neb., and eight miles of pipe near Goodland, Kan., all with larger pipe, and the looping of six miles of pipe running southwest of the Palco, Kan., compressor station.

Line for Southeast Missouri

Pipeline facilities that will benefit the southeastern Missouri communities of Sikeston and New Madrid have been okayed for the Associated Natural Gas Co. of Tulsa by FPC.

The company will spend $934,000 to build 14.5 miles of 8⅝-in. from a Big Inch connection at Oran, Mo., to Sikeston, and 21 miles of 6⅝-in. line from Sikeston to New Madrid. Associated has a 20-year, 1.5 MMcf-per-day contract with Texas Eastern Transmission Corp., previously authorized by FPC, for gas delivery. If it can get the gas, Associated intends to extend its service within the next five years to 10 other Missouri communities.

Ohio Fuel Plans 22-Mile Line

Ohio Fuel Gas Co., Columbus, filed an application with FPC last month for permission to build 22 miles of 16-in. pipeline and to remove the 330-hp Vandalia station.

Ohio Fuel would use the line as a connection between two points on its transmission system. The addition would allow the company to meet increased demands in existing gas markets, including a wholesale purchaser, Dayton Power & Light Co. Cost would approximate $780,000.

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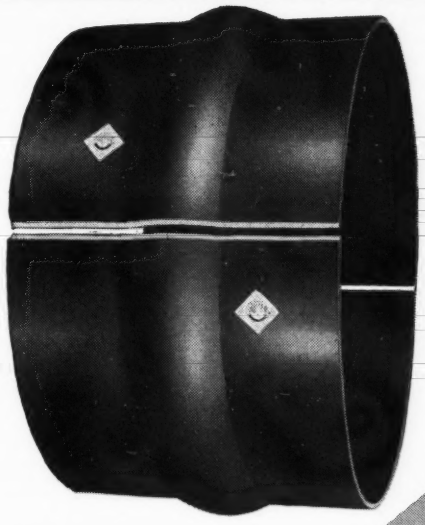

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Difficulties Rectified, Plans For Arkansas Gas Shape Up

With two firms splitting the territory, plans have now crystallized for the introduction of natural gas to east and northeast Arkansas, Gov. Sidney McMath has announced.

After Mid-South Gas Co. had revealed plans to tap Texas Gas Transmission Co.'s line on the west bank of the Mississippi near Helena (*GAS*, June, p. 103), Arkansas-Missouri Power Corp. grabbed a franchise to serve Blytheville, a key point in the northeast section. Accordingly, Mid-South first said it could not serve certain towns lying between the two cities, but later changed its mind—and its engineering plans. So now gas will blanket the adjoining areas.

Mid-South, capitalized for $12 million, will serve towns as far north as Paragould. It has already bought the natural gas properties of Arkansas Power & Light, Pine Bluff.

Mountain Fuel Sets Up Production Subsidiary

Mountain Fuel Supply Co., Salt Lake City, announced to its stockholders last month that it has applied for Utah and Wyoming public service commission okays to form a $20-million subsidiary company, which will henceforward handle the exploration for and production of natural gas to be distributed by the company. Mountain Fuel does not expect to change its distribution operations under the proposal.

Mountain Fuel is currently engaged in development of the new Church Buttes natural gas fields in Wyoming. It presently draws gas from fields in Washington, Utah, Colorado, and Wyoming, which it serves to customers in Salt Lake City and about 30 other cities and towns in Wyoming and Utah.

In making the move, Mountain Fuel has its eye on the 102,000 customers it intends to serve by next year (present total: 74,900). To do this, the company envisions a necessary peakload of 200 MMcf daily—and an annual supply of 45 billion cu ft, about 50% more than is presently available.

Equitable Files Pool, Pipe Plan

A proposal that would result in connection of its system with Texas Eastern's Big Inch line, and with the Pratt and Jefferson (Pennsylvania) storage pools, has been filed with the Federal Power Commission by Equitable Gas Co., Pittsburgh.

Equitable wants to build a new compressor station, a dehydration plant, and a total of 32,200 ft of 16-in., 4700 ft of 12-in., 42,000 ft of 6-in., and 11,000 ft of 8-in. pipeline, all near Waynesburg, Pa. The new facilities would boost Equitable's capacity to 21 MMcf per day.

Gas would be received from Texas Eastern and stored in the proposed Pratt and Jefferson storage fields, for withdrawal during peakload periods.

Georgia Natural Withdraws

Georgia Natural Gas Co. has withdrawn its application to FPC for the 335-mile pipeline it had proposed to build to serve southwestern Georgia and Tallahassee, Fla. The withdrawal became effective June 25.

In its request for withdrawal of the application, Georgia Natural said that since its proposal had requested consideration only if the similar line applied for by Atlantic Gulf Gas Co. were refused, it cannot be considered as a matter of law. Also, Georgia Natural said that the numerous intervenors in the proceedings involving its proposal made it obvious that its plan was considered by many to be competitive with other gas companies. This was not Georgia's intent, and therefore it decided to withdraw.

States Lose Tidelands Case

Texas and Louisiana are no different from California, the Supreme Court decided last month.

The court ruled that the federal government has paramount rights to the submerged oil lands off the coast adjoining the two states. And—they must account for any money obtained from drilling leases since June 1947, the date the California case was decided.

Opining that the Union admitted all states on equal footing, the court threw out, 5-2, the Texas contention that when it was annexed it owned rights to all lands 140 miles out into the gulf. Louisiana's stand that it should have rights to 27 miles of tidelands was turned down by a 7-0 decision.

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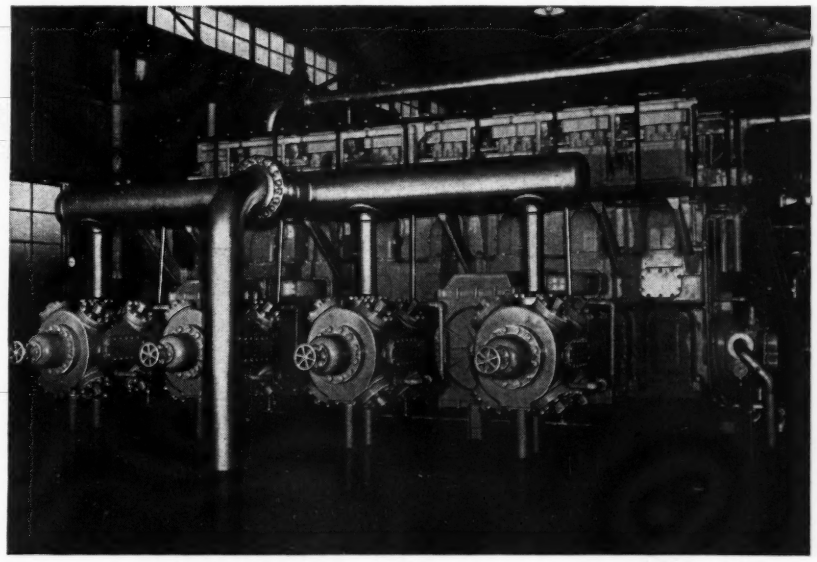
PIPELINE OFFICIALS GATHER TO SEE REVOLUTIONARY NEW ANGLE GAS ENGINE COMPRESSOR

Tennessee Gas Transmission Company's New Worthington Uniflo TYPE UTC-16 Draws Visitors From Near And Far



The Tennessee Gas Transmission Company's new Worthington Angle Gas Engine Compressor — uniflo TYPE UTC-16 — installed at Monroe, La. The Company's natural gas pipeline will reach Buffalo, N. Y., and further extension is planned.

So widespread was the interest in Worthington's new Angle Gas Engine Compressor, TYPE UTC-16, that engineers and other executives from transmission companies all over the country came to see the first of these units in actual service — at the Tennessee Gas Transmission Company's Monroe, La., plant.

Advance notices of outstanding performance were fully lived up to, observers being particularly enthusiastic over the new uniflo scavenging. This radical improvement over conventional loop design provides more than double the port area and 50% more exhaust area. Straight-line air flow thoroughly cleanses and cools the entire cylinder, and timed valves retain greater weight of pure air for perfect combustion and stepped-up supercharging.

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En bloc frame, with removable cylinder liners . . . double air manifolds . . . completely symmetrical outer piston walls, wrist-pin in separate carrier . . . cone-type cylinder head, with streamlined passages and two large exhaust valves . . . gear driven camshafts for positive drive and perfect timing . . . positive pressure lubrication through cast-in manifolds to all moving parts . . . large access doors on both sides of frame for complete accessibility . . . Worthington Feather* Valves, most efficient ever made, in all cylinders.

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On pipeline duty, in refinery service— in fact, wherever gas must be compressed and suitable gas fuel is available — the uniflo TYPE UTC-16 offers dependability and economy never before possible . . . proof that, as always, *there's more worth in Worthington.* Learn more about this outstanding advancement in angle gas engine compressors. Contact your nearest Worthington Branch Office or the *Worthington Pump and Machinery Corporation, Engine Division, Buffalo, N. Y.*

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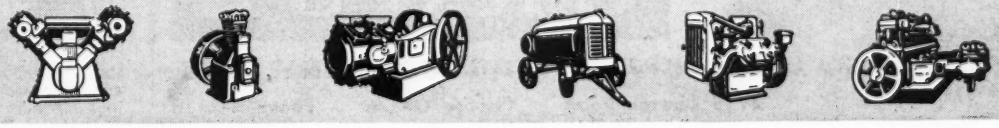
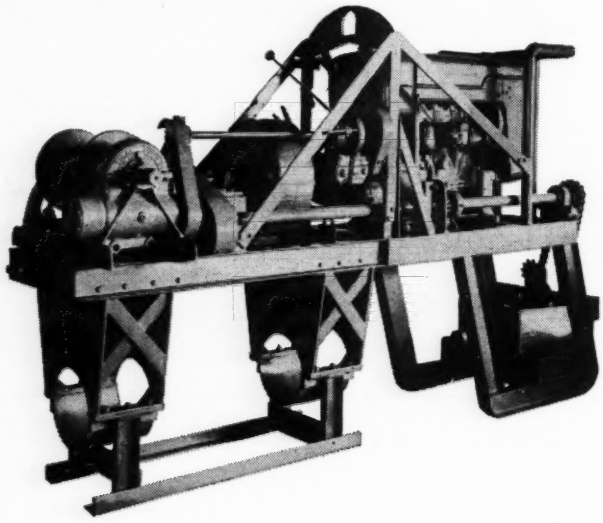
NO OTHER COMPRESSOR WILL OUTPERFORM A WORTHINGTON

Y-Types Vertical Horizontal Portable Radial Gas-Engine Compressors

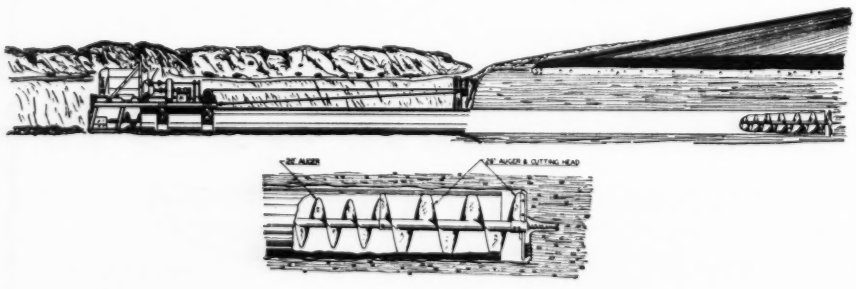


IS YOUR JOB BORING



CROSE AUGER TYPE ROAD BORING MACHINE

installs pipe casing up to and including 34″ in diameter. This machine has proven highly satisfactory with Pipe Line Contractors for the fastest method of installing pipe casing where rock is not encountered. Machines for installing casing larger than 34″ in diameter are also available.



M. J. CROSE MANUFACTURING COMPANY, INC.

2715 Dawson Road TULSA, OKLA. Phone 6-2173

Toronto Wants TGT Gas

Toronto, Can., wants Texas gas.

And Consumers Gas Co. has a plan for getting it.

General Manager E. J. Tucker announced early last month that, if FPC clears the path, the company will enter into an agreement with Tennessee Gas Transmission Co. to take gas at the Buffalo end of the TGT line and transport it through a $6 million, 85-mile line.

The 20-in. line would require about 18 months to lay, and if FPC should move quickly Toronto might start receiving gas in two or three years.

Progress Reports

Planned

ACME NATURAL GAS CO., Butler, Pa., 26 miles of 6- to 10-in. line, local.

ALGONQUIN GAS TRANSMISSION CO., a 276-mile line from a connection with Texas Eastern's line at Lambertville, N. J., to Boston, with 492 miles of laterals and a compressor station in Middleton, Conn., included.

ARKANSAS-MISSOURI POWER CO., Blytheville, Ark. To build line from Big Inch to serve 12 towns in two states. To start within year.

ATLANTIC GULF GAS CO., 1500 miles, Alabama to Florida, Georgia, South Carolina.

CAROLINA NATURAL GAS CORP., Charlotte, N. C., 372 miles, 18 lines, from Transcontinental Gas Pipe Line Corp. main line to North and South Carolina communities.

CENTRAL KENTUCKY NATURAL GAS CO., Charleston, W. Va., for 32 miles, 20-in. loop from North Means, Ky., to Nicholas county, Ky.; one compressor in North Means station.

CITIES OF BOONEVILLE, RIPLEY, BALDWYN, Miss., to connect with Tennessee main line in Benton county, 16 miles of 6-in., 23 more miles, 11-mile tap.

COLORADO INTERSTATE GAS CO., 175-mile, 20-in. line from the West Panhandle area of Texas to the company's Lakin, Kan. compressor station, and a 4800-hp compressor station.

CONSUMERS GAS CO., Toronto, Can., 85 miles, Buffalo to Toronto.

EAST OHIO GAS CO., Cleveland, for 24 miles from Petersburg, Ohio, to Austintown station near Youngstown. Start in August, complete in November.

EL PASO NATURAL GAS CO., line from San Juan basin, New Mexico, to Topock, Ariz.

EQUITABLE GAS CO., Pittsburgh, 17 miles of 8- to 16-in., 3520-hp booster, dehydration plant, near Waynesburg, Pa.

JERSEY CENTRAL POWER & LIGHT CO., Asbury Park, 7 miles.

KANSAS-NEBRASKA NATURAL GAS CO., Phillipsburg, Kan., 1640 hp compressor addition, 4 miles of 2-in.; replace 16 miles of 8-in. with 12-in., 22 miles of 6-in. with 8-in., 8 miles of 4-in. with 6- and 8-in.; loop 6 miles.

LAKE SHORE PIPELINE CO., ERIE GAS SERVICE CO. INC., AND GRAND RIVER GAS TRANSMISSION CO., pipelines from a Meadville, Pa., connection with Tennessee Gas Transmission's line westward to Ohio.

MISSISSIPPI RIVER FUEL CORP., St. Louis, for compressor units totaling 28,380 hp in seven new stations; 4100 hp in existing stations, in Louisiana, Arkansas, Missouri. Four 12-in. river crossings 40 miles from Dubach, La., to Perryville.

On every job, we emphasize

Personal Supervision

LAST YEAR, our policy of emphasizing personal supervision insured the complete satisfaction of our customers on the construction of 562 MILES OF PIPELINES! This same personal supervision is available for your pipe line jobs in 1950. And, in addition, please remember that when TROJAN handles your pipeline construction jobs, you get the full benefit of an organization of experienced personnel, ample equipment and financial stability.

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A *different* Asbestos Felt because it is made of long asbestos fibers which eliminate the necessity of adding organic materials (such as hairs and wood pulp) for strength.

Because GAMA Felt is made of high purity asbestos, it has lower water absorption, is non-rotting, and provides the best possible protection for long pipe line life.

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GAMA ASBESTOS PIPE LINE FELT IS DESIGNED:

- **To prevent soil stress on coatings.**
- **To prevent backfill damage.**
- **To pull coatings tightly to the pipe.**
- **To give even thickness of enamel on bottom, sides, and top of pipe.**
- **To be a protection for the coatings beneath it.**

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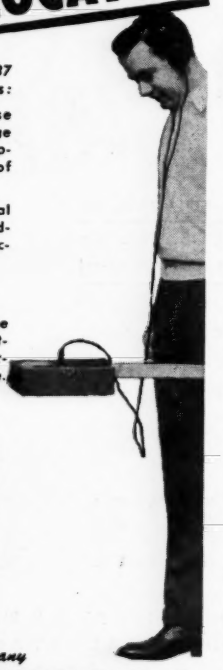
GOLDAK MODEL 87
Featherweight
PIPE LOCATOR



Only the Goldak Model 87 offers these BIG features:

PENTODE TUBES: These tubes have biased voltage which makes possible sharply defined separation of closely spaced pipes.

MICROTUNING: The metal handle is quickly and rigidly locked for perfect electronic balancing.

APPROVED LICENSE: The Goldak Company manufactures the only Pipe Locator licensed by Western Electric, added assurance of better performance.

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• **EXACT** location of buried pipes, mains, gates, tees, etc. • Total weight, 11 lbs. — one man operation! • Strong, positive location signal. • Standard miniature radio tubes and flashlight batteries. • Lasts a lifetime — guaranteed performance.

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NEVADA NATURAL GAS PIPE LINE CO., 122 miles of 10¾-in. line from Topock, Ariz., to Las Vegas, Nev.

NEW YORK STATE NATURAL GAS CORP., New York, 70 miles of 20-in. from Westmoreland county, Pa., to connection with Big Inch.

NORTHEASTERN GAS TRANSMISSION CO., pipeline to Massachusetts, Connecticut, Rhode Island, Maine, Vermont, and New Hampshire. In all, 501 miles of 3- to 20-in. line, in loops and laterals, in New England.

NORTHWEST NATURAL GAS CO., for 700 miles in Washington, Idaho, Oregon.

OHIO FUEL GAS CO., Columbus, 22 miles of 16-in. near Dayton, remove 330-hp Vandalia compressor station.

PANHANDLE EASTERN PIPE LINE CO., Kansas City, Mo., for 185 miles and 16,000 hp in compressor stations.

PEOPLES NATURAL GAS CO., Pittsburgh, 16 miles of 8- and 10-in., from Tennessee Gas spur in Big Beaver to borough of Midland, Beaver county, Pa. Start July, complete August.

PIEDMONT NATURAL GAS CO. INC., Spartanburg, S. C., six laterals totaling 74 miles, from Transcontinental main line to North and South Carolina cities.

PUBLIC SERVICE CO. OF COLORADO, pipeline from the Piceance Creek field in western Colorado to Grand Junction and Rifle.

PUBLIC SERVICE CO. OF NORTH CAROLINA INC., Gastonia, 365 miles connecting at 10 points with Transcontinental main line in North and South Carolina.

SOUTH CENTRAL ALABAMA NATURAL GAS CO. INC., 150-mile pipeline from a connection with Southern Natural's line in Elmore county.

SOUTHEASTERN MICHIGAN GAS CO., Chicago, 55 miles of 12-in. from connection with Panhandle Eastern main line in Oakland county, Mich., to Marysville, Mich.

SOUTH GEORGIA GAS CO., Atlanta, for 248 miles: Talbot county to Brooks county, 144 miles, plus 104 miles of laterals.

SOUTH JERSEY GAS CO., Atlantic City, 77 miles, Camden to Atlantic City.

TENNESSEE NATURAL GAS LINES INC., Nashville, 24 miles of line near Nashville.

TEXAS EASTERN TRANSMISSION CORP., Shreveport, to boost capacity to 476 MMcf, 791 miles 30-in. from Kosciusko, Miss., to Connellsville, Pa.; seven compressor stations with 46,400 hp on new line, six with 52,500 hp on existing line; short lines in New York area; 35 miles of 30-in. from Fayette county, Pa., to Westmoreland county, Pa.

TEXAS ILLINOIS NATURAL GAS PIPELINE CO., Chicago. For 1134 miles, $117 million.

TRANSCONTINENTAL GAS PIPE LINE CORP., Houston, 11-mile mainline extension, 20- to 26-in. pipe, East Carteret, N. J., to Brooklyn.

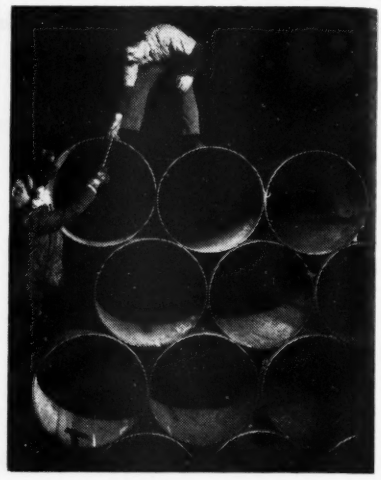
UNITED GAS PIPE LINE CO., Shreveport, 51 miles of 12-in., from Soso and Sherron fields, Miss., to Meridian; 24 miles of 16-in., Mud Lake field, La., to Port Arthur, Texas; 93 miles of 6- to 16-in. from Paquemines parish fields to New Orleans.

Approved

ASSOCIATED NATURAL GAS CO., Tulsa, 35.5 miles of 6- and 8-in. in southeastern Missouri.

IROQUOIS GAS CORP., 23 miles of line from the Holland and Bennington fields to other company lines.

TRANSCONTINENTAL GAS PIPE LINE CORP., Houston. To expand capacity of Texas-to-New York line with nine compressor stations with 134,560 hp; additions to laterals.



STRAP TIGHTENING operation on a gondola-load of 30-in. pipe from the new National Tube Co. electric welded pipe mill (McKeesport, Pa.) is shown above. The new mill, which will have a capacity of 100,000 tons annually of 26- to 36-in. steel pipe, started production last month.

TRUNKLINE GAS SUPPLY CO., Chicago, for 740 miles from Louisiana to Illinois.

Bids Open

COMMONWEALTH NATURAL GAS CORP., Richmond, Va., to start in July on 183-mile line from Greene county, Va., to Norfolk and Newport News.

NORTHERN NATURAL GAS CO., Omaha. Missouri river crossing in Cass county, Neb.

Contracts Let

CITY OF CHARLOTTESVILLE, Va., to Lehman, Hoge & Scott, 13 miles 6-in., 1 mile 8-in., start in July, complete by Aug. 1.

TENNESSEE GAS TRANSMISSION CO., Houston. To H. C. Price Co., Bartlesville, Okla., 373-mile 26-in. extension from north bank, Ohio river, near Portsmouth, Ohio, to Buffalo, N. Y. Four initial spreads: 1, 63 miles from near Youngstown, Ohio, southward; 2, 63 miles, Muskingum river northeastward; 3, Muskingum river southwestward, 47 miles; 4, 47 miles, Ohio river northeastward. Remainder to be started in August. Entire project to be complete in fall.

TEXAS GAS TRANSMISSION CO., 12-in. line from Slaughters, Ky., to Evansville, Ind. Two Ohio river crossings. To J. Ray McDermott, Harvey, La.

Under Way

ALABAMA-TENNESSEE NATURAL GAS CO., 70-mile line from Muscle Shoals, Ala., to Decatur and Huntsville.

ARKANSAS-LOUISIANA GAS CO., Shreveport. About 91 miles — Magnolia, Ark., to Malvern, Ark. — completed on the 163-mile, 20-in. Waskom, Texas, to Malvern line. Anderson Brothers Construction Co., Houston.

CENTRAL HUDSON GAS & ELECTRIC CORP., Poughkeepsie, 40 miles from Tuxedo to Poughkeepsie.